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FEBRUARY 2, 1979

SPECIAL ISSUE

NATIONAL REVIEW

The Anti-Nuclear Lobby

BERNARD L. COHEN

WHY?
WHO?
THE ARGUMENT.
THE AWESOME COST.

B. Bruce-Briggs
George Brumlik
Milton R. Copulos
Brian Crozier
Samuel McCracken
M. Stanton Evans
George Gilder
Arthur Gray Jr.
Erik v. Kuehnelt-Leddihn
Wil Lepkowski
D. Keith Mano
Malachi B. Martin
George Miley
Alan L. Miller
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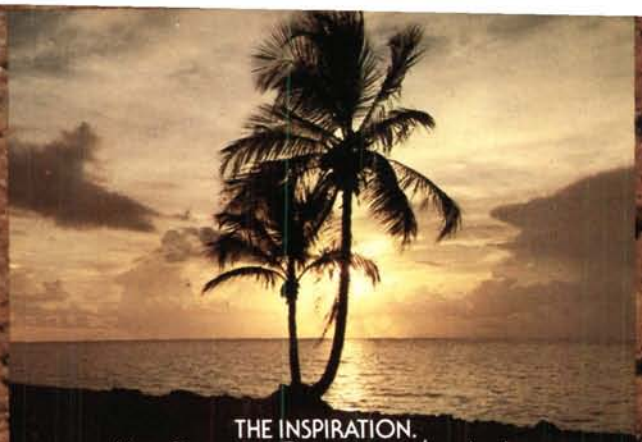

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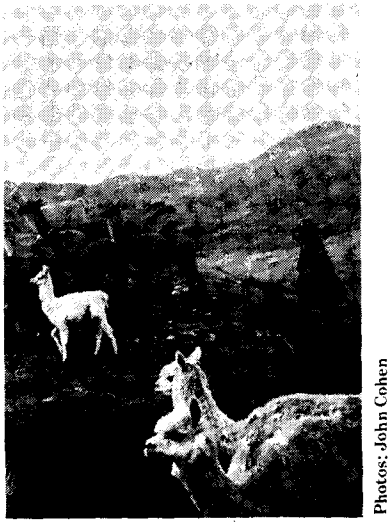

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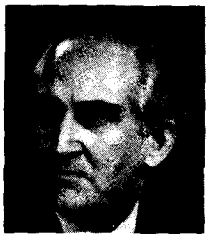
NATIONAL REVIEW

FEBRUARY 2, 1979
VOL. XXXI, No. 5
ISSN: 0028-0038



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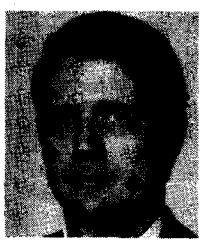

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Cover photo by NASA Photographs

NATIONAL REVIEW is published weekly, except for one issue in January, by National Review, Inc., at 50 Emmett St., Bristol, Conn. Second-class postage paid at Bristol, Conn.

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Address all editorial mail, manuscripts, letters to the editors, etc. to Editorial Dept., NATIONAL REVIEW, 150 East 35th St., New York, N.Y. 10016. Address all subscription mail orders, changes of address, undeliverable copies, etc., to Circulation Dept., NATIONAL REVIEW, 150 East 35th St., New York, N.Y. 10016. Adjustment requests should be accompanied by a current mailing label or facsimile.

RATES: *$34.00 a year ($19.00 for the 48-page issues, and $15.00 for 8-page issues published on the alternate weeks). Add $2.00 for Canada, $4.00 for other foreign subscriptions, per year. The editors cannot be responsible for unsolicited manuscripts unless return postage, or better a stamped, self-addressed envelope, is enclosed. Opinions expressed in signed articles do not necessarily represent the view of the editors.*

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The Lazy Man's Way to Riches

'Most People Are Too Busy Earning a Living to Make Any Money'

". . . I didn't have a job and I was worse than broke. I owed more than $50,000 and my only assets were my wife and 8 children. We were renting an old house in a decaying neighborhood, driving a 5-year old car that was falling apart, and had maybe a couple of hundred dollars in the bank.

Within one month, after using the principles of the Lazy Man's Way to Riches, things started to change – to put it mildly.

- *We worked out a plan we could afford to pay off our debts – and stopped our creditors from hounding us.*
- *We were driving a brand-new Thunderbird that a car dealer had given to us!*
- *Our bank account had multiplied tenfold!*
- *All within the first 30 days!*

And today . . .

- *I live in a home that's worth over $250,000.*
- *I own my "office". It's about a mile and a half from my home and is right on the beach.*
- *I own a lakefront "cabin" in Washington. (That's where we spend the whole summer – loafing, fishing, swimming and sailing.)*
- *I own two oceanfront condominiums. One is on a sunny beach in Mexico and one is snuggled right on the best beach of the best island in Hawaii.*
- *I have two boats and a Cadillac. All paid for.*
- *I have a net worth of over a Million Dollars. But I still don't have a job . . ."*

I used to work hard. The 18-hour days. The 7-day weeks.

But I didn't start making big money until I did less–a *lot* less.

For example, this ad took about 2 hours to write. With a little luck, it should earn me 50, maybe a hundred thousand dollars.

What's more, I'm going to ask you to send me 10 dollars for something that'll cost me no more than 50 cents. And I'll try to make it so irresistible that you'd be a darned fool not to do it.

After all, why should you care if I make $9.50 profit if I can show you how to make a *lot* more?

What if I'm so sure that you *will* make money my Lazy Man's Way that I'll make you a most unusual guarantee?

And here it is: I won't even cash your check or money order for 31 days *after* I've sent you my material.

That'll give you plenty of time to get it, look it over, try it out.

If you don't agree that it's worth *at least a hundred times* what you invested, send it back. Your *uncashed* check or money order will be put in the return mail.

The only reason I won't send it to you and bill you or send it C.O.D. is because both these methods involve more time and money.

And I'm already going to give you the biggest bargain of your life.

Because I'm going to tell you what it took me 11 years to perfect: How to make money the Lazy Man's Way.

O.K.–now I have to brag a little. I don't mind it. And it's necessary–to prove that sending me the 10 dollars . . . which I'll keep "in escrow" until you're satisfied . . . is the smartest thing you ever did.

I live in a home that's worth $250,000. I know it is, because I turned down an offer for that much. My mortgage is less than half that, and the only reason I haven't paid it off is because my Tax Accountant says I'd be an idiot.

My "office," about a mile and a half from my home, is right on the beach. My view is so breathtaking that most people comment that they don't see how I get any work done. But I do enough. About 6 hours a day, 8 or 9 months a year.

The rest of the time we spend at our mountain "cabin." I paid $30,000 for it–cash.

I have 2 boats and a Cadillac. All paid for.

We have stocks, bonds, investments, cash in the bank. But the most important thing I have is priceless: time with my family.

And I'll show you just how I did it–the Lazy Man's Way–a secret that I've shared with just a few friends 'til now.

It doesn't require "education." I'm a high school graduate.

It doesn't require "capital." When I started out, I was so deep in debt that a lawyer friend advised bankruptcy as the only way out. He was wrong. We paid off our debts and, outside of the mortgage, don't owe a cent to any man.

It doesn't require "luck." I've had more than my share, but I'm not promising you that you'll make as much money as I have. And you may do better; I personally know one man who used these principles, worked hard, and made 11 million dollars in 8 years. But money isn't everything.

It doesn't require "talent." Just enough brains to know what to look for. And I'll tell you that.

It doesn't require "youth." One woman I worked with is over 70. She's travelled the world over, making all the money she needs, doing only what I taught her.

It doesn't require "experience." A widow in Chicago has been averaging $25,000 a year for the past 5 years, using my methods.

What *does* it require? Belief. Enough to take a chance. Enough to absorb what I'll send you. Enough to put the principles into *action*. If you do just that–nothing more, nothing less–the results *will* be hard to believe. Remember–I guarantee it.

You don't have to give up your job. But you may soon be making so much money that you'll be able to. Once again–I guarantee it.

The wisest man I ever knew told me something I never forgot: "Most people are too busy earning a living to make any money."

Don't take as long as I did to find out he was right.

Here are some comments from other people. I'm sure that, like you, they didn't believe me either. Guess they figured that, since I wasn't going to deposit their check for 31 days, they had nothing to lose.

They were right. *And here's what they gained:*

$260,000 in eleven months

"Two years ago, I mailed you ten dollars in sheer desperation for a better life . . . One year ago, just out of the blue sky, a man called and offered me a partnership . . . I grossed over $260,000 cash business in eleven months. You are a God sent miracle to me."

B. F., Pascagoula, Miss.

Made $16,901.92 first time out

"The third day I applied myself totally to what you had shown me. I made $16,901.92. That's great results for my first time out."

J. J. M., Watertown, N.Y.

'I'm a half-millionaire'

"Thanks to your method, I'm a half-millionaire . . . would you believe last year at this time I was a slave working for peanuts?"

G. C., Toronto, Canada

$7,000 in five days

"Last Monday I used what I learned on page 83 to make $7,000. It took me all week to do it, but that's not bad for five day's work."

M. D., Topeka, Kansas

Can't believe success

"I can't believe how successful I have become . . . Three months ago, I was a telephone order taker for a fastener company in Chicago, Illinois. I was driving a beat-up 1959 Rambler and had about $600 in my savings account. Today, I am the outside salesman for the same fastener company. I'm driving a company car . . . I am sitting in my own office and have about $3,000 in my savings account."

G. M., Des Plaines, Ill.

I know you're skeptical. After all, what I'm saying is probably contrary to what you've heard from your friends, your family, your teachers and maybe everyone else you know. I can only ask you one question.

How many of them are millionaires?

So it's up to you:

A month from today, you can be nothing more than 30 days older – or you can be on your way to getting rich. You decide.

Sworn Statement:
"On the basis of my professional relationship as his accountant, I certify that Mr. Karbo's net worth is more than one million dollars."
Stuart A. Cogan

Bank Reference:
Home Bank
17010 Magnolia Avenue
Fountain Valley, California 92708

Joe Karbo
17105 South Pacific, Dept. 591-E
Sunset Beach, California 90742

Joe, you may be full of beans, but what have I got to lose? Send me the Lazy Man's Way to Riches. *But don't deposit my check or money order for 31 days after it's in the mail.*

If I return your material – for *any* reason – within that time, return my *uncashed* check or money order to me. On that basis, here's my ten dollars.

Name _____

Address _____

City _____

State _____ Zip _____

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Letters

In Search of Education

I was four years old in 1959, the first time Dorothy Sayers' instructive essay was published in *NR* ["The Lost Tools of Learning," Jan. 19], and I am walking proof that her strictures were not accepted by the American education establishment. The only thing medieval about my education was the music sung in church, and even that dissipated with the trendy folk-rock of the 1960s. By republishing this essay, NATIONAL REVIEW has given us all, as it were, a second chance.

Yet I have one objection. Miss Sayers contends that "the sole true end of education is simply this: to teach men how to learn for themselves." The ends, in other words, *are* the means. I disagree. Miss Sayers' tools, though indispensable, are only the implements to achieve "the sole true end of education": the achievement of a moral understanding, as defined by the best tradition of Western civilization. Tools, after all, are only tools.

Megan Thomas
Fort Wayne, Ind.

Confidence Men

Just when I finally had convinced myself that Watergate was the aberration of one Administration, and that it was only in the Democratic Party that unethical methods were still employed (as in the ERA extension), Mr. William Rusher's article ["Raising Conservative Bucks," Dec. 8] uncovers the gross lack of integrity that exists in fund-raising in the Republican Party. I'm nauseated!

To think that I, in good conscience, may respond, for instance, to an anti-abortion appeal for funds, only to have that money funneled to a pro-abortion candidate, goes beyond any compromise that I could tolerate in the name of political necessity. To me it is tantamount to stealing, and if there is no law against such misappropriation of funds, there ought to be. In any case, there *is* a Higher Law against such things. And any party that practices such deception jeopardizes its chances of ever being in the majority again, because its potential supporters will not contribute to a group they cannot trust, or elect its members to office. I am grateful to Mr. Rusher for helping me rule out from consideration any requests from the Republican National Committee, even if their letters were to be signed by Pope John Paul, Billy Graham, and Saul of Tarsus.

Nicholas Cava
Oakland, N.J.

Sunrise or Sunset?

M. Stanton Evans, in "The Sunset Dawn" [Dec. 8], discussed the application of sunset laws to federal agencies and gave them qualified support, his qualification having to do with the prevailing uncertainty as to what our congressmen actually intend to accomplish through these measures.

In fact, from experience with sunset laws at the state level, we know there are generally three categories of legislators who support these laws. First, there are the old pros who want to blackmail a segment of the populace that does not always help to finance their re-election. A periodic scare will keep these interests financially productive for the legislator.

A second group of legislators who support sunset laws is the lawyers. Some lawyers see in the sunset laws an opportunity to rewrite the laws that establish the agencies, or to rewrite the agencies' rules to multiply the number of litigable issues. Everything must have its years in court. A third kind of legislator hates our system of government. This legislator will seize every opportunity sunset laws provide to disrupt our governmental and economic machinery.

It is not likely that we will get legislatures in the foreseeable future that will tackle the problems of expanding government "on a substantive basis." It thus becomes difficult to give the "sunset" idea—at the state level, at least—any kind of support.

William A. White
Sacramento, Calif.

Twisted

Yale Brozen has no need to be astonished by the fact that the antitrust laws are being used to punish efficiency and productivity ["The Antitrust Witch Hunt," Nov. 24]. It is painfully obvious that any law using such an undefined (and undefinable) term as "restraint of trade" may be twisted by an ambitious Federal Trade Commission bureaucrat into whatever meaning he chooses.

Stephen Reed
Evanston, Ill.

Rhythm and Blues

Michael C. Brown's "Ten Year Overview" of *Humanae Vitae* [Dec. 8] prompts me to defend the practice of artificial birth control. My defense will not be comprehensive; just a few notions, largely intuitive, of what sex is and what it is for.

1. There is nothing wrong with sexual pleasure. The reason intercourse is re-

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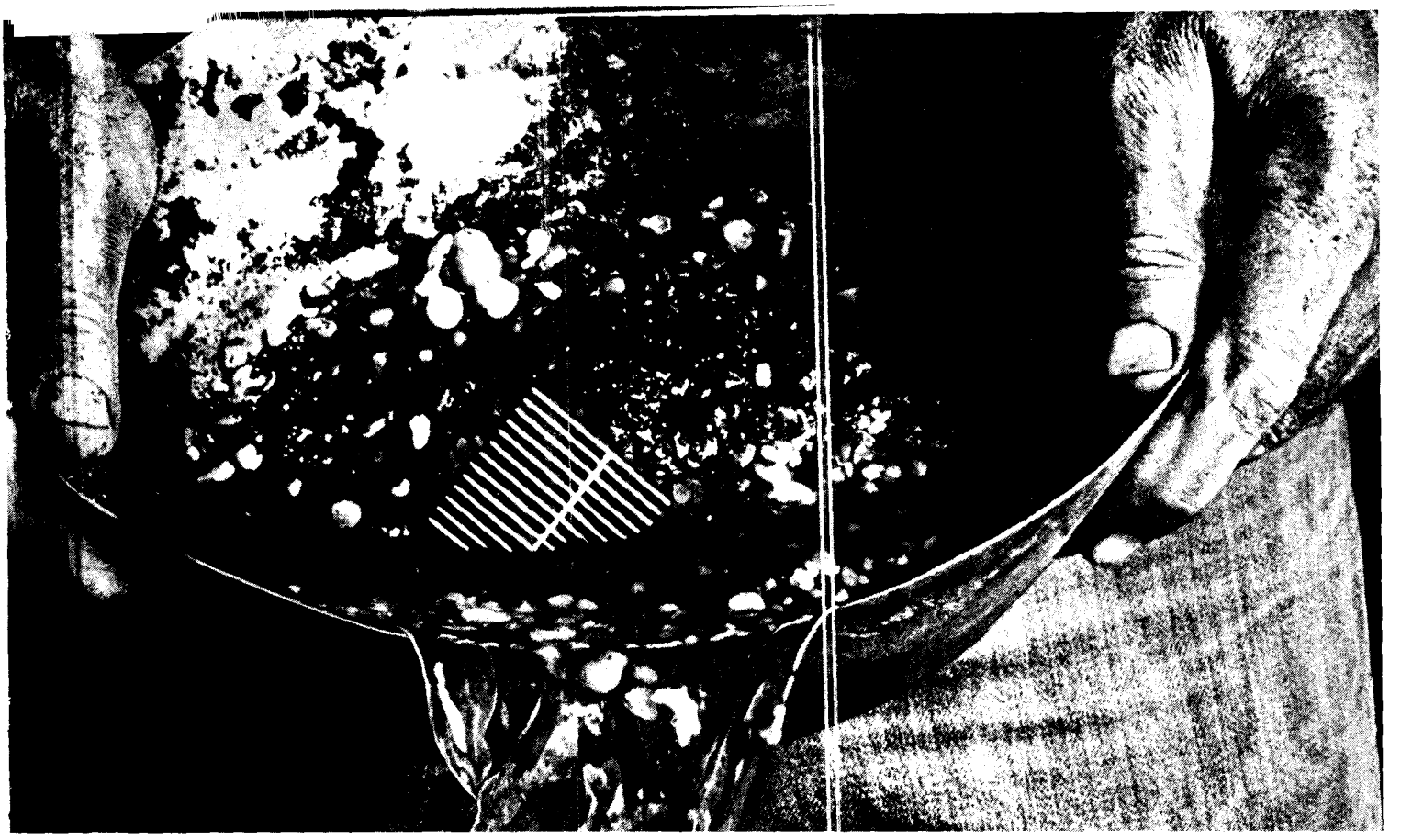

One of the biggest gold strikes since Sutter's Mill.

The yield: 3,000 pounds of pure gold.

But it didn't come from a mine. It came from a Western Electric factory.

A new kind of Midas Touch

That's where Western Electric's new process for plating gold is *conserving* the precious metal, through increased efficiency and precision. It's producing better switching components for the Bell System, to make your phone service clearer and more reliable than ever.

It must be gold that's plated to the switching components you see glittering in the photograph, because no other metal can provide the same kind of efficient, reliable, durable, and clear telephone transmission.

But until now, gold-plating had always been a messy and imprecise process. There had been no way to control it accurately. No way to avoid depositing excess gold on the places it was intended to go. And on the places it wasn't.

So Western Electric, working with Bell Labs, designed a totally new system to do the job. Combining the best of electro-chemical and programmed logic control technologies, the new system can plate gold with hair-thin precision. Depositing only the desired amount, only on the designated spot. With no waste whatsoever.

Gilt-edged savings

Besides producing a much better product, Western Electric has gained a savings of $9 million from the process. And that's another way we're helping your Bell Telephone Company hold down the cost of your phone service.

Even bigger benefits

And since the new process uses 55% less gold than the old one, we could more than double production of our improved switching component. Without consuming any more of the shiny natural resource.

But there are more environmental plusses. The new process has almost completely eliminated the gaseous wastes plating used to produce. It's cut the liquid wastes by 90%. And it runs on 67% less power.

This improved gold-plating technique is another way Western Electric is working to hold down the cost, while continually raising the quality of your phone service.

Keeping your communications system the best in the world.

Western Electric

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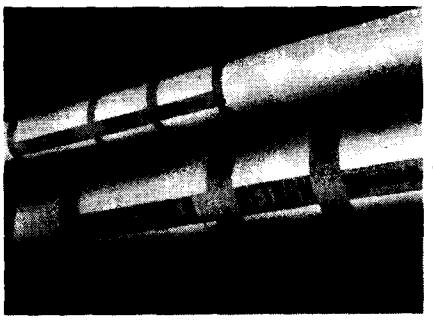
As a member of the American business community since 1914, we at Brady are all too familiar with the negative aspects on the social and economic levels of our society. We try to do what we can to change them.

But we're positive, too. Especially positive about the many freedoms we enjoy as a part of American business. Like *freedom to innovate* in our field—adhesive and graphics chemistry. With each year we proudly bring to market several unique new products designed in some way to help make information clearer, work safer, products more attractive, or jobs more productive.



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served for the married is that intercourse presupposes a spiritual, as well as physical, union, one that only marriage can engender. Marriage does not somehow legitimize an evil action, sex. Rather, sex is an integral part of marriage, one of the things that make marriage good. There would be nothing wrong with including on one's list of reasons to get married, "I want to make love with my spouse." The Church, however, still seems to treat sex as something to be transcended or overcome, except when functionally necessary, i.e., to make babies.

2. At a practical level, the rhythm method fails. I am living evidence, not of my parents' incontinence, but of the practical flaws of rhythm. Also on a practical level, the three to five days a month of female fertility—and, hence, abstinence under the rhythm method—can expand to as many as twenty days a month because of the uncertainties of rhythm. It is not within my imagination to picture as normal a marriage abstinent two-thirds of every month.

3. Since my observations are subjective, allow me to say that I love my Church and will never abandon her. Were she ever to proclaim the anti-birth-control doctrine as divine dogma, I would not hesitate to obey it. I sincerely hope that a practical and effective means of natural birth control will arise by the time I marry, because artificial methods seem a cold and calculating way to raise a family. I cannot, however, believe that practicing artificial birth control is sinful.

Robert K. Olsen
Placentia, Calif.

Confusions

In his remarks in praise of John Chamberlain ["Notes & Asides," Dec. 8] William F. Buckley Jr. refers to C. S. Forrester as the originator of the quote, "If the alternative is to betray one's country or one's friends, one must not hesitate to betray one's country." He means E. M. Forster, late author of *A Passage to India.* Coincidentally, P. N. Furbank, in his recent biography, writes that Forster, while making the Washington party rounds in 1947 during a rare visit to the States, was often confused with C. S. Forrester and "grew hardened to being thanked by strangers for his immortal Captain Hornblower."

Gary Van Graafeiland
Rochester, N.Y.

Contrary to the statement in "For the Record" [Dec. 22], not only will the Kansas legislature meet in 1979 (for three months), but it will do so with both houses controlled by the Republican Party.

G. Joseph Pierron
Olathe, Kan.

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BOMBSHELL BESTSELLER!

mething good ... ppening in America. Co rvatives are n... ger crying in the wilderne: ngry Californ... send Proposition 13 lan ding to victory ... nd liberals and conservativ ree that it's just the beginning. The remarkab ff Bell beats one ... the Senate's top liberals—i e *New Jersey* ... mary. Even *Newsweek* ru ories like "The Regulation Mess." Finall merica is waking up.

ormer Treasury Secretary William Simon loom the prophet of the new awakening. In thi werful book, he insists that "the America ople would demand massive reforms if the derstood" that ...

America is only a few steps behind Englan and New York City. (Simon draws the mora from these case histories of democratic socialism.)

There is an invisible cause behind America's decline, a creeping, spreading New Despotism.

American capitalists are propping up the Soviet Union—and have been from the begin ning. (Simon cites names and dates.)

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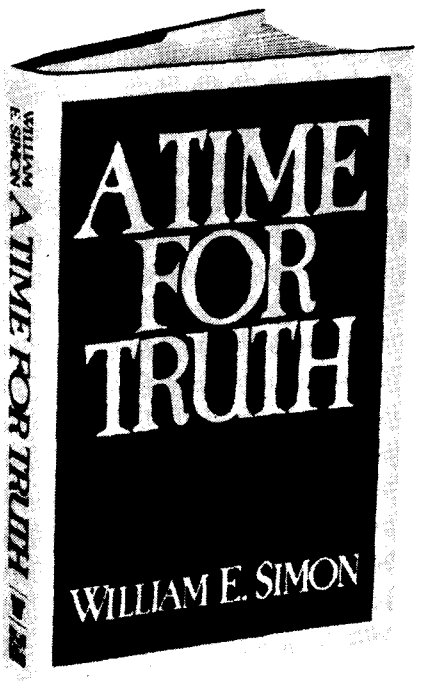

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FOR THE RECORD

■ There's going to be a hot time in the old town next October 7 if the burgeoning anti-nuclear forces have their way. They plan a **Vietnam War-style extravaganza**—a mass march on Washington—as the culmination of a year-long series of conferences, seminars, legal actions, sit-ins, demonstrations, and, some threaten, sabotage, both here and abroad, against nuclear power installations. . . . Don't think protests don't work, **Daniel Ellsberg** told demonstrators in Colorado last April. They did, he reminded them, in Vietnam. . . . "It's not only demonstrations, it's propaganda," says the ubiquitous **Terry Provance**, late of American Friends Service Committee (AFSC) and Stop the B-1 Bomber (SB-1B), now of Women's International League for Peace and Freedom (WILPF), World Peace Council (WPC), and Mobilization for Survival—both national (MFS) and international (IMFS). . . . Provance told Louisville, Ky. **National No-Nukes Strategies Conference** (August 15-20, 1978) that anti-nuclear propaganda has been pretty damn effective, to wit, the turning around of public attitudes toward the **neutron bomb** from two-thirds in favor (July 1977), to two-thirds against (August 1978), in just 13 months. This operation was largely orchestrated by Communist-controlled WPC. (See p. 164.)

■ **Operation '79** was pretty well mapped out in Louisville, at subsequent **Mobilization for Survival Conference** (Des Moines, September 15-17), with additional ginger tossed into pot by **Ralph Nader**'s Critical Mass ("a citizen's movement for safe and efficient energy") Conference in Washington, D.C. (October 5-8). Central casting is providing a cast of thousands —mostly leftists, but of assorted shapes and vintages. . . . **Benjamin Spock** and

Jon, *London Daily Mail* Rothco

"May I suggest Peking Duck with peanut butter, sir?"

Grace Paley, arrested at **Seabrook**, the Gold Medal winner among anti-nuclear hooplas in '78—15,000 demonstrators turned out, according to police; 20,000, according to Trotskyist *Militant*. . . . **Daniel Ellsberg** made the scene at Rocky Flats, Colo., Barnwell, S.C.—he also managed a suspended sentence. . . . **Tom Hayden** told Critical Mass Conference: "The anti-nuclear struggle should be to America during the Eighties what the antiwar movement was in the Sixties." (Ah, those nostalgia buffs!) . . . **Morton Halperin** (a former high-level National Security Council official suspected of leaking important secrets to the press) is offering services of his anti-intelligence organizations (Center for National Security Studies, Campaign to Stop Government Spying) to anti-nukers. . . . **National Lawyers Guild**, legal front for CPUSA, is handling defense of arrested demonstrators, through its Anti-Nuclear Task Force. . . . Plus new faces on the scene the often anarchistic, fiercely independent local leaders of the various Alliances: **Clamshell**, **Pancake**, **Kudzu**, **Catfish**, **Abalone**, **Trojan Decommissioning** (make ours Baloney).

■ Tactics: They run all across the board. An oldie, the proposal at Louisville to stage Nuremberg "war crimes" trial of **Joseph Hendrie**, chairman of Nuclear Regulatory Commission, by the Union of Concerned Scientists (nuclear power development equals crime against humanity). . . . New: Effort to organize "Native Americans," Australian aborigines, black South West Africans into anti-nuclear front. Purpose: to disrupt **uranium mining**. . . . Novel approach: Groups are organized to protest various aspects of nuclear power generation: transportation of nuclear materials, decommissioning of nuclear plants, export of nuclear technology—this last centered on preventing sale of nuclear facility by **Westinghouse** to Philippines. . . . Degree: **Sam Lovejoy** of Clamshell Alliance, favors violence and sabotage, boasts that nearly $1 million damage was done to Minnesota power lines last year, hints sabotage of power lines this year will cost more. So far the Lovejoys are a very small minority. . . . Internal rifts are apparent between **Communists** and **Trotskyists**, also between those who oppose all use of the atom and those who want the bomb but not the power plant.

■ Several recent entries into anti-nuclear lists have some leading nuclear opponents worried, e.g., "**Direct Action Occupation**," "**Julius and Ethel Rosenberg Affinity**," and—not least—the "**Anarcho-Feminist Love Brigade**" (Slogan: Make Love, Not Watts?)

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"Your Attorney" discusses the pros and cons of using an attorney. It cites the legal requirements in various states for real estate settlements. It tells what services, if any, might be rendered by an attorney. Shown also is a real estate Deed (or Title). This is the legal document issued to you as owner and is recorded for public record.

"Obtaining Tenants" deals with the various ways of obtaining the most desirable tenants. A typical application form is illustrated showing the information that should be required from a prospective tenant. This section also explains what security deposits are and how to handle them. Security deposit receipt forms are furnished and may be photocopied. The lease is so important that it is dealt with separately.

In ***"The Lease"*** a comprehensive sample is given and the handling of special conditions is explained. Also discussed are how to make changes in the lease and what to do if the lease agreement is violated.

"Expenses vs. Income" breaks down all operating costs including mortgage amortization, taxes, insusrance, heat, water, etc. It explains how to keep expenses well below the income level of each property. It also explains how to increase your immediate profits by maximizing the tax benefits from all expenses. Following are two of the actual case histories given with photographs and complete financial analyses:

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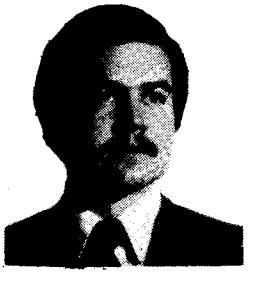

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THE WEEK

■ Evans and Novak report that, Fritz Mondale excepted, members of the Administration were elated by the Abzug firing. Even some members of the Women's Advisory Committee have called the White House to say they resigned only because of pressure from Big Feminism, and to tender their services for a later date when all the noise dies down. Though Mr. Carter has merely done belatedly what the voters of New York have been doing consistently, Bella has been on tour with a kind of female impersonation act to characterize his action as caddish. As for the President, the dope is that he did it because he wanted to appear Strong, as a President must. (True, he did consult Mrs. Carter first). And what the heck, why shouldn't he be able to do to Bella Abzug what he did to Taiwan?

■ When not rallying in defense of furbish louseworts, snail darters, pussy willows, or crabgrass, the eco-lobby could often be found rallying against supersonic transport aircraft. The SST, the eco-lobby had it, would dangerously deplete the ozone—a layer of oxygen present in the atmosphere which shields the earth from ultraviolet radiation. Thanks in large part to Luddite pressures, the U.S. opted out of the SST derby. Now comes evidence that the naysayers had it exactly wrong. Four California scientists, writing in *Nature*, report that they have found that worldwide SST fleet operations would result in a "substantial ozone layer enhancement."

■ A Martin Luther King Jr. national holiday? Why not. While we're at it we can repeal Antony's plaintive business about how the good we do is oft interred with our bones, while the other stuff survives. Some of the other stuff is on magnetic tape, courtesy of Robert Kennedy; and there was the absent-mindedness in King about human rights when those who trampled on them were blacks or Communists. So . . . but you could assemble quotes by Abe Lincoln making him out to be a racist, and episodes from the life of Socrates for the purpose of remembering him as a pederast; you could write only about Thomas Jefferson the slaveowner. Martin Luther King *had* a vision, devoted his life to it, was a man of rhetorical genius, and argued for a kind of consummation of the Civil War. Let us forget the rough edges, and recognize a great black American.

■ Governor Jerry Brown of California, in his second inaugural address, continued the good work begun in 1972 by Governor Ronald Reagan. "I will support an appropriate constitutional amendment to limit state and local spending," said Brown, who thereupon went national, urging the fifty states to "join together to demand a constitutional amendment that will serve as the occasion for finally restraining the inflationary spending of the Federal Government." Six states have already passed their own state constitutional amendments to limit spending. Thirty other states are moving along that line. In ten days the National Tax Limitation Committee (100,000 members, plus Milton Friedman) will present to the new Congress, in Washington, the result of six months of deliberations: draft language for a spending-limit amendment to the U.S. Constitution.

■ Opponents of nuclear power have had a relatively easy time of it. The bodies were out there, former Vietnam demonstrators, Bertrand Russellites, Naderites, environmentalists, leftists of all sorts looking for a cause (see "For the Record"). But now there are some stirrings in the pro-nuclear camp as well. Barbara Keating's Consumer Alert (1091 Post Road, Darien, Conn. 06820) is taking an active interest in the nuclear power dispute. And the First National Conference on Energy Advocacy and the Nuclear Option will be held at the Mayflower Hotel in Washington, D.C., February 2-4 (for info write The Heritage Foundation, 514 C St. N.E., Washington, D.C. 20002).

■ Mrs. Jeannine Honicker opened up a can of worms when she petitioned the Nuclear Regulatory Commission (NRC) to close down America's nuclear power industry because it "produces radiation and radioactivity that results eventually in an unacceptable number of deaths and injuries to present and succeeding generations." In turning down Mrs. Honicker's petition, the NRC pointed out that there was no scientific basis for her charges and took the opportunity to describe exactly what a termination of the present nuclear power industry would mean to the U.S. It would, says the NRC, cost the

SPECIAL ISSUE: *Nuclear*

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United States $60 billion to replace atomic plants now in operation and would cost electric power consumers an additional $9.6 billion annually. The new generating mix would have to be 20 per cent coal-fired and 80 per cent oil-fired, says the NRC, because there would not be enough miners to produce enough coal for a largely coal-based industry, nor enough railway cars to carry the coal to the generating plants. A probable result of a move away from nuclear power would be "reduced output [that could] force the shutdown of 20 per cent of the commercial and industrial sectors of the economy."

■ One of Mr. Carter's big campaign issues was the moral wasteland of the Nixon days. One of Mr. Nixon's proudest achievements was his opening up communications with Communist China six years ago. At that time Mr. Nixon dealt with Premier Chou En-lai and Chairman Mao, who kept a certain troublemaker named Teng Hsiao-ping in jail. Get it? Now Carter's in, Nixon's out, Chou's out, Teng's in, and the Moral Wasteland has been invited to dinner at the White House on January 29 to honor the paroled Chinese Jailbird. Mr. Nixon has accepted. Gerald Ford, also invited, found himself otherwise engaged. But he never did enjoy fancy cooking.

■ Trumpet music, Dorian style. The moving strains of "Hail to the Chief." Harken ye to President Carter's stern defense of SALT II and assertion of the national interest. Failure to ratify, he says, would "deal a severe blow to American-Soviet relations." Also diminish "the opinion held of us by peace-loving people in the small and developing nations around the world." Tsk. So it wasn't the Gettysburg Address. Forget that early music. Let the trumpets play taps.

■ Kallie Knoetze fought (and won) in Miami after all, despite the earnest efforts of Jesse Jackson and the State Department to exclude him for "moral turpitude." The crux of the matter is, quite simply, racial. As a policeman in South Africa, Knoetze shot a black youth during a riot; the boy's leg was amputated. Had the boy been white, Jackson & Co. would have paid no attention. And were all governments to ban foreign fighters of the turpitudinous persuasion, there would never be another international boxing match. Knoetze's opponent had done time for manslaughter.

■ Last month, a meeting of the Interamerican Regional Organization of Workers convening in Lima adopted an AFL-CIO resolution favoring a labor boycott of Chile, plus Cuba and Nicaragua. After two days of discussion in Washington, a meeting of hemisphere trade-union organizations decided not to set a date for the proposed boycott. The real target of the boycott would be Chile, with Nicaragua a secondary target. The effect on Cuba would be nil. Since American labor unions unload ships from the Soviet Union, China, East Germany, Czechoslovakia, Rumania, Poland, and other oases of free trade-unionism, the call for a boycott has the sound of a tinny tocsin.

■ Okay, so we didn't know Iran was going to fall. But at least the CIA isn't opening Tom Hayden's mail.

■ On the legislative front, the good news is that Connecticut has repealed its mandatory horseshoe-shaped-toilet-seat law, on the books and enforced since 1939. The bad news is that the municipal council of Umanak, Greenland, has banned beer and liquor sales, depriving citizens of much-needed antifreeze.

■ Red China celebrated its recognition by the U.S. by ordering 16,000 cases of wine from Canada. Which works out to 1/200th of a jigger of wine per Chinese. Celebration in the U.S. was somewhat more restrained.

■ A DePauw University computer student has discovered a weighty correlation between coeds' hip size and their grade point average, the larger the one, the higher the other. No similar correlation was found between bust size and grade point average. Another great bureaucratic career has been launched.

■ In our last episode, John Rideout was acquitted of rape. Now he and Greta have reconciled, thereby stripping the gears of feminist presses throughout the nation. Will John Rideout now be appointed chairperson of the President's newly established Men's Advisory Committee? Stay tuned.

■ Cleveland has not been located for comment since defaulting on its bonds. According to unconfirmed reports, the city may be hiding out in Costa Rica.

■ Big question among diplomats now is whether the President can normalize relations with his relations.

Power

Prometheus Bound

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The Story

This special issue of NATIONAL REVIEW—unique in the history of the magazine—emerges after over a year of gestation. It began casually enough. In the fall of 1977, Bernard L. Cohen attacked in these pages some of the myths and misconceptions surrounding plutonium ("The Case for the Breeder Reactor," September 16, 1977). "This material," he wrote, "has fallen victim to an insidious campaign of slander and half-truths that has blackened its public image beyond recognition." Plutonium, Mr. Cohen added in the post-publication, tidying-up-loose-ends correspondence, was not alone: nuclear power, in general, was wrapped in a cloud of misinformation. The problem was not simply political. Nuclear power faced an army of eloquent and energetic opponents. These, Cohen and his colleagues believed, could be answered in an open debate. The guardians of public opinion—the politicians, the popularizers, the press—seemed singularly unwilling, however, to let that debate occur. Journalists repeated and amplified the grossest errors; poseurs were accorded the status of sages; the scientists who knew what they were talking about ended up talking chiefly to themselves—until the nuclear community began to despair of ever setting the record straight. "We very badly need some help from the media," Mr. Cohen wrote.

The most effective form of help, it seemed at first, would be a simple Question and Answer session, *NR* asking, a scientist responding. The questions, however, quickly moved beyond the boundaries of science. Gradually the perception crystallized that ideology was blinding us to an opportunity of tremendous social and geopolitical import. The debate over nuclear power raised a host of questions, cultural, economic, political, philosophical—questions which, the editors felt, could be adequately explored only by an entire issue of NATIONAL REVIEW.

II

At many times in history, man's grasp has exceeded his reach. Facts and innovations that will seem revolutionary to later generations lie neglected or unused. Eighteen hundred years before circumnavigation, Eratosthenes of Cyrene not only assumed the earth was round, but calculated its circumference. Hippo of Alexandria devised a steam turbine in the first century B.C. Many such discoveries, of course, found no practical use at the time. Others were ignored out of a kind of cultural indifference: society was occupied with other things. Still others, however, were suppressed by superstition or fear.

The nuclear option, if forsaken by the West, will fall into the third category. The dangers of nuclear power as caricatured, through assertion and implication, by its opponents are as terrifying as any image of sea serpents lurking beyond the Canaries. Terrorists will fabricate bombs in basements; governments, in reply, will abolish democracy; wastes will poison the soil for millions of years; cargoes of toxic fuels will careen recklessly across the Republic, while clouds of radioactivity, squirted from casually ruptured reactors, will creep about the landscape like malevolent fog-banks. This is the picture, only slightly exaggerated, which is generally accepted—by much of the press and publishing industry, and too many of our political leaders. It is a picture colored (at best) by ignorance, and (at worst) by bad faith.

It is also a picture which it is important to correct, since the material well-being of our nation depends on the continued development of nuclear power. No rational man believes that the atom—or any other fuel source—can satisfy all our energy needs *by itself*. Yet no rational man should believe that we can do without nuclear power. America's industry and economy runs on electricity; nuclear power is the cheapest, safest, and cleanest way of generating it. Oil prices fluctuate at the whim of sheiks who live within spitting distance of the Soviet Union. Coal is dirty, dangerous, and needed for other things—chemical feedstocks, steel. We can't build very many more dams, unless we get some new mountain ranges. Wind, the sun, the sea, all lie untapped, waiting for the future, at which time they may still be expensive or impractical. We can continue then with nuclear power—or empty our pockets and dim the lights.

The response of the government has been inadequate, to put it politely. American uranium supplies will last until the 1990s. Fast breeder reactors extend the nuclear option for thousands of years. The fusion reaction could extend it indefinitely. The present Administration, meanwhile, seems bemused by gas bills and Sun Day. The

From an Industrialist's Diary

I started out with coal,
  But coal made Nader mad;
That's when I switched to oil—
  Till gas became the fad.
Then back again to coal
  When oil went through the roof.
Now Jimmy's pushing gas.
  I guess I'll always goof.

W. H. VON DREELE

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proponents of the two chief forms of nuclear power (fission and fusion) differ among themselves on questions of cost and scheduling—a difference *NR* has not tried to iron out in the contributions that follow. But this debate —a debate between real alternatives—should be at the heart of national energy discussions, not relegated, as it now is, to the rhetorical boondocks.

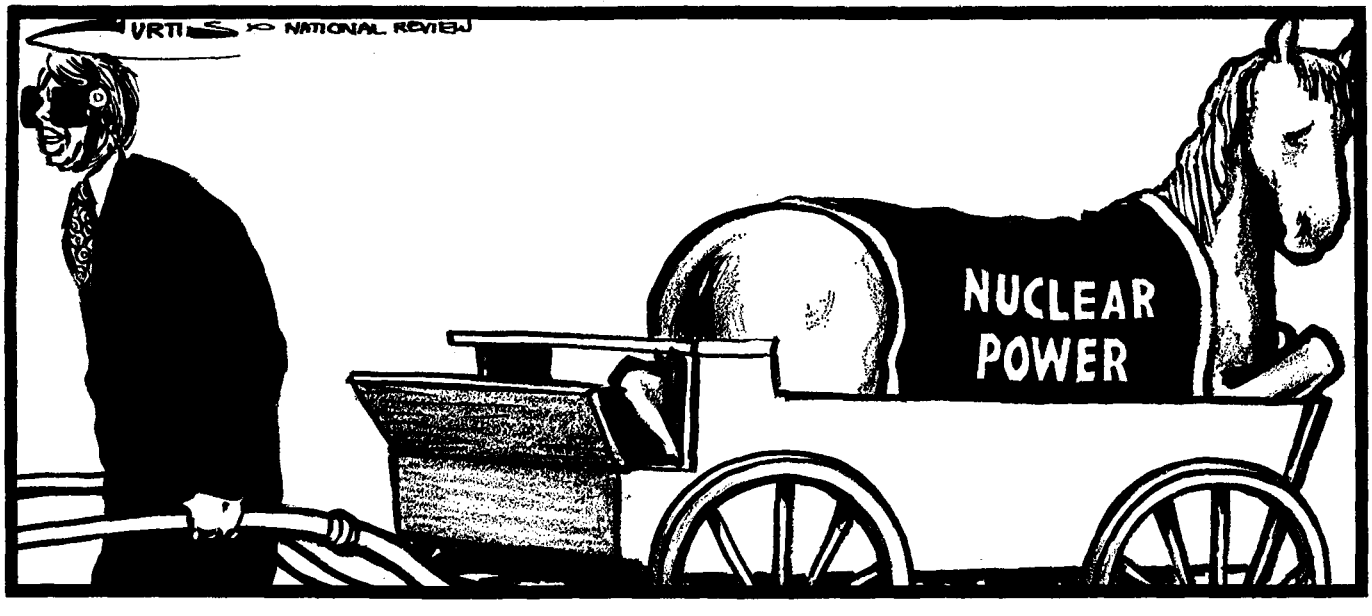
Nuclear power, in addition to all its other benefits, will not require major assaults on the federal treasury. Fission power, throughout its history, has been tied to the government, since enrichment and reprocessing facilities must, for security reasons, remain a government monopoly. Utilities are charged, however, for the services they receive, as they will also be charged for waste disposal. Fusion advocates, like the partisans for any developing technology, occasionally slip into a paternalistic mode as a justification for the funding of their programs. The contributors to this issue, however, suggest specific ways of defraying the expense. Others might be devised, if this is the course we decide to take. Let the discussion begin.

III

America—and, by extension, the West—faces three great dangers, if the anti-nuclear movement has its way. The first is geopolitical, and has been described generically by Senator Church (see also Cato): "As energy is the basis for the world's economic well-being, it may well hold the key to future peace or war." It is possible to be more precise. The policy of the Soviet Union, in the Middle East, in the Horn, and in the southern tip of Africa, is directed to controlling the oil lifeline of Western Europe. The Soviets covet Middle Eastern oil, partly for their own uses (see Brian Crozier, "The Cost Gap of '79," *NR*, January 19), partly as a pressure point on their enemies. Soviets take a lively interest in the radical anti-nuclear campaigns in the West, even as they develop and expand their own nuclear power program. The Shah has just gone on vacation, and the remaining pro-Western states in the Middle East are governed by regimes much more fragile than his was thought to be. America, with considerable belt-tightening, could survive the Sovietization of Arab oil. Western Europe and Japan, if they continue to rely on it, could not.

The second danger is domestic. Many opponents of nuclear power are not against the use of energy *per se*; a great number, however, oppose all large-scale alternatives in a manner that goes much further than traditional conservation. If we all consumed less—lived the simple life—ate natural foods—we would escape cancer, high blood pressure, and tooth decay. They draw on an unarticulated feeling that "high living standards" are somehow synonymous with electric toothbrushes and fur-covered whoopee cushions. Assuredly they are wrong. The well-being of the poor (to say nothing of the middle class) depends on a healthy, functioning economy—which depends on energy. The political consequences of mandating lower living standards would be far more repressive than anything fantasized by the harshest critics of power-plant security.

The third disaster would occur as an anticipation of the first two. If international blackmail and catastrophic recession loom as serious threats, then America will get its energy—by whatever means possible. If the life cannot be breathed back into the body of the nuclear power industry, then we will fall back on other fuels—ruinously. The process is already occurring. Roger Starr has noted in *The American Spectator* that the zeal of New England environmentalists in protecting the furbish lousewort has only driven the utilities to a vast and destructive hydroelectric project in the truly virgin wildernesses of Quebec. Worse could be expected in the face of war or impoverishment. To borrow a metaphor from another scientific controversy: "[It would] be a terrible detriment for the soul if people found themselves convinced by proof of something that it [had been] made a sin to believe" (Galileo to the Grand Duke of Tuscany).



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Dominion Over, Well, Pine

The scene has become familiar, almost boring. One thinks of a carnival mock-up, made of plywood. On it we see crowds milling about, cars overturned, newsmen talking excitedly, troops running, helicopters. There is a head-sized hole in the plywood.

In this carnival photograph, however, the head-shot is usually carried on page one of the newspaper. The Shah of Iran is only the latest to have thrust his head through that particular hole in the plywood. He has been photographed preparatory to his disappearance into the dustbin of history.

Analyses and recriminations will multiply. The Shah modernized too quickly or too slowly. He antagonized the feudal mullahs, or he was dilatory about getting rid of them. He was too dictatorial, or he was not tough enough to discipline either his own political elite or the boiling Iranian political cauldron. A case can be made for each assertion above, and a thousand PhD theses will argue each permutation.

Disaster has overtaken the Carter Administration. All odds seem to be against long survival for the present government of Prime Minister Shahpur Bakhtiar, a regime without an Iranian constituency. What appears to be in store is an Islamic "republic" organized along the xenophobic and reactionary lines laid down by the redoubtable Ayatollah Khomeini—bad news for the U.S., for Europe, for Israel, and for Egypt, among others.

The hole in that carnival plywood goes empty once again. With the retreat of Western power in the world, an enormous destabilization spreads, against us. The CIA has been reduced to an information-gathering agency, but not so its rivals. Violence, spontaneous and otherwise, increases in quantum leaps. The skies darken in the Persian Gulf.

Who will be the next pro-Western leader to put his face through that hole in the plywood, as a U.S. ally in an exposed position? By now the carnival portraits make a remarkable exhibition.

Exposing the China Card

Meeting on January 15 with some eight hundred American businessmen, Secretary Vance and Security Advisor Brzezinski put some flesh on the bones of our new relationship with Peking and Taipei. A new American Institute in Taiwan—a government-funded "corporation" registered in the District of Columbia—will be the vehicle for conducting American relations with the Republic

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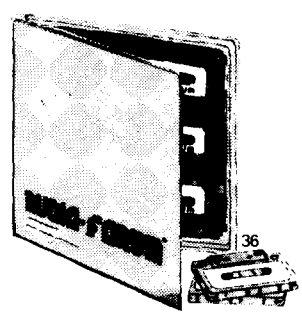

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LETTER FROM WASHINGTON

Although frightening notions continue to circulate concerning the possible blow-up of nuclear plants and other such chimerical hazards, most congressional opposition to development of the peaceful atom focuses on a single issue: disposal of radioactive wastes.

This has become a central issue for two reasons: First, because Congress got a jolt last year when it was told by Senator Gary Hart (D., Colo.) and others that uranium mine tailings, previously thought to be harmless, in fact presented a radiation problem; this information prompted enactment of legislation to divide responsibility for disposal between the Federal Government and the states. Second, because the Federal Government has not developed a coherent policy for disposing of the waste products created in the nuclear cycle.

Official foot-dragging on this issue, oddly enough, has been abetted by nearly everyone involved in the nuclear debate. The Department of Energy (DOE) has been slow to move, it says, because the most appropriate technologies have yet to be identified. The nuclear power industry has been reluctant to commit itself to some irreversible disposal method since this would short-circuit efforts to reprocess wastes as a potential source of energy.

Most significant of all, a solution to the disposal problem has been resisted by elements in the anti-nuclear lobby. This sort of opposition stems from the perception that, so long as there is a disposal problem which is viewed as a source of radiation danger, public reliance on nuclear power will be difficult if not impossible to attain. It is therefore in the interest of those who most volubly decry the safety problems associated with nuclear energy to prevent those problems from being resolved.

■ Representative Barry Goldwater Jr. (R., Calif.) proposes to break this impasse by requiring the Federal Government to bind itself to a definite timetable on nuclear waste disposal. Last year Goldwater submitted a bill (HR-13644) which, without attempting to dictate use of a particular technology, would force the DOE to come up with a program for solving the problem, a recommended set of technologies, and a national waste depository, by 1985. With such a program on track, Goldwater contends, there would be nothing to prevent us from pushing ahead full speed with the development of nuclear energy.

In point of fact, the technology needed to solve the problem is pretty well known: it's called "vitrification" and in essence consists of reducing nuclear wastes into a solid, glassified form resembling pyrex, then burying these in salt deposits which are known to be extremely stable geologically. The only superior methods of disposal (compatible with vitrification) are recycling waste materials into nuclear fuel, and "breeding"—using the plutonium produced in the fuel cycle to manufacture still more plutonium from uranium-238. Comprehensive recycling could reduce the quantity of wastes to be disposed of by 80 per cent—as well as producing abundant new supplies of energy. [See also p. 142.] Unfortunately, this is the method of waste disposal that the anti-nuclear lobby and its friends in the Carter Administration most vehemently oppose.

Senator James McClure (R., Idaho) has been trying to salvage the breeder option from the debris of Carter's energy policy: last summer he succeeded in getting an agreement from the Administration to put the Clinch River breeder project on hold rather than actively moving to phase it out, and spending $1.5 billion over a three-year period to determine if other types of breeder technology at other sites would be feasible. On McClure's analysis, the Administration end of the bargain is a commitment to plutonium in some fashion. Such a commitment, plus Goldwater's bill, would go far to resolve the waste disposal issue and move the peaceful atom off dead center.

■ Though the political line-up on "sleeper" issues like nuclear power can change rapidly, the array of forces in Congress, for and against, is neither entirely partisan, nor entirely ideological. Liberals tend to want to go slowly, but there are exceptions—the chief one being Senator Frank Church (D., Idaho). Church, as chairman of the Senate Energy Research and Development subcommittee, supports the Clinch River fast breeder program. "The breeder program," he said in a November 1977 speech, "is the only technology now on the horizon which holds out [to Europe and Japan] the promise of relief from an unremitting dependence upon foreign-held fuel. . . . The world is running short of energy. The possibility that nations will embark on military adventures to secure sufficient energy will increase as supplies dwindle and living standards stagnate." When the White House took a potshot at this speech, Church was defended in the *Washington Star* by former colleague Eugene McCarthy: "Liberals have never held that new technology should be buried because there is danger in it, or that new knowledge should be suppressed."

—CATO

of China. The Institute will perform the usual commercial, cultural, and consular functions of the Embassy —the same arrangement the Japanese have used since they recognized Peking. We are to assume that behind all this, the officer in charge will carry on a *sub rosa* political relationship between Washington and Taipei.

More interestingly, Vance and Brzezinski's presentations raised a couple of corners on Washington's rather shallow view of what it has done. For example, while obviously pleased that our Defense Treaty with Taipei has not been abrogated but merely terminated effective 12 months hence, Vance indicated we will sell no military equipment during the year although we *may* do so thereafter. A perverse twist. Vance also referred to Vice Premier Teng's informal statement to U.S. senators that change in Taiwan will come about indigenously over a hundred or so years and will not be forced by Peking. Presumably this and other, similar unilateral statements represent Peking's pay-off to the U.S. for its hands-down acceptance of Chinese conditions on recognition. Elsewhere, Peking has referred to Hong Kong and Macao as illustrations of the range of possibilities open to Taiwan, and there is no doubt that in her long history, Mother China's ample skirts have covered other such anomalies.

What is alarming is the simplistic view expressed by Vance and Brzezinski—one hopes only for the sake

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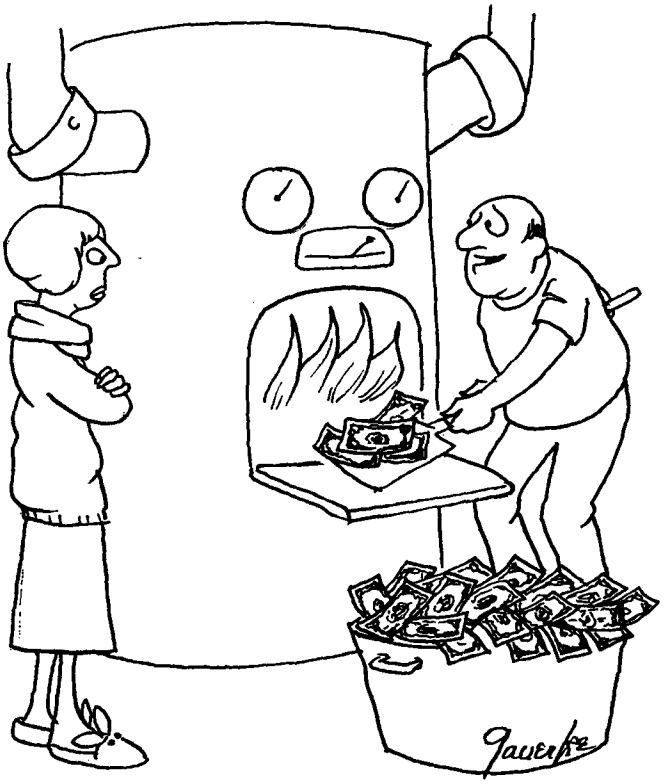

"At last I've hit upon a cheap source of energy, Janet."

of appearances—of the strategic significance. On one level, both spoke rather piously of the felicitous relationship the U.S. and USSR could have within the new framework including China, Japan, and Western Europe, ignoring the fact that all these are regarded as rivals by the USSR. After rhetorically noting such inconvenient items as Iran, Indochina, the Horn of Africa, and Afghanistan, Brzezinski quickly went on to say that nearly everything is for the best. Since neither man is that simple, one is inclined to focus on Brzezinski's presentation to Moscow of a choice "whether to become a responsible partner in the creation of a global system of genuinely independent states or whether to . . . derive its security exclusively from its military might and its domination of a few clients."

Here is the real danger—that in "playing the China card," the Administration believes that it has boxed the USSR inescapably into a corner, where it has no choice but to come out and play the game "our way" or else freeze on a shrinking military-cum-satellite base; that it now has China as a permanent offset to compensate for our weakening military posture vis-à-vis the USSR; that it has ensured there will be no tactical Sino-Soviet rapprochement (comparable to the Hitler-Stalin Pact of 1939), and no sudden new internal shift in China. In short, we face the danger that having played the China card the Administration may have emptied its hand and become dependent on that one card—which is not likely to be an ace.

Showing the Flag

Twelve F-15s have been dispatched
To Saudis, in a hurry,
Although, of course, they've been disarmed
So no one has to worry.
I gather Jimmy sees them as
"A gathering of eagles,"
But I believe he might as well
Dispatch a pack of beagles.

W. H. VON DREELE

Haig Returns

Could another NATO commander make it to the White House? The resignation of General Alexander Haig as commander of the NATO forces naturally gives rise to such speculation among those who recall the Eisenhower for President movement, and indeed among some who participated in it.

Because of his performance at NATO, Alexander Haig enjoys an extraordinary reputation in Europe. "Haig," said one senior NATO official, "is a rare blend: a military man with a very sure, intuitive touch for the political implications and repercussions of what happens in his area of responsibility. Eisenhower had it, Gruenther had it. Not too many others have." "Haig's grasp of the political dimension," editorialized *Die Welt*, "meant he could talk to the politicians in terms that stuck. Politicians credit his military expertise, but realize he is more than a military man."

In the view of senior European officials, Haig possesses a much clearer understanding of the dangers posed by Soviet policies than does his former boss, President Carter.

Where do these developments leave Haig politically? He lacks a domestic political base. Should he enter the New Hampshire Republican primary, chances are he would sink out of sight in the multi-candidate race. Barring some catastrophe of an entirely different order from those we have got used to, it seems unlikely that there will come into being a spontaneous Haig for President movement. Instead, a number of leading Republicans think Haig might well try for that inviting Pennsylvania Senate seat left open by the decision of Richard Schweiker not to seek re-election.

However, Haig will in all likelihood be a sharp critic of the SALT II treaty when the Senate debates commence, and that is bad news for President Carter.

William Yandell Elliott, R I P

While studying literature at Vanderbilt, Bill Elliott ran with the poet-pack known as "the Fugitives." By 1917 he had his master's degree in English. He went to Europe and fought in the First World War, stayed on and

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received a certificate in French literature from the Sorbonne in 1919. By 1925 he was teaching government at Harvard. by 1933 he was chairman of the department. For thirty more years he taught courses, wrote books, consulted with governments, guided dissertations. In 1963 he retired to Virginia and his first love, the teaching of literature.

His big mistake was to love the United States, to hate the Communists and the Fascists prematurely, and to teach politics as if it sprang from a moral view of human life. For these heresies he was ridiculed by teenaged yahoos at Harvard and occasionally hissed at in class (he would hiss right back).

They called him Wild Bill, and wild he must have seemed to the lockstep leftists in charge of policy and preferment in the 1930s and 1940s. But he was just one of the good old breed, and we could have used a thousand more.

G. Warren Nutter, R I P

Writing in 1962, Professor Colin Clark of Oxford observed that there was a myth going the rounds that the Soviet Union was undergoing faster economic growth than the U.S. and would soon overtake the U.S. The myth, wrote Professor Clark, "has received almost universal credence, and has been stated by many authorities, including spokesmen of the United States Government and of its intelligence services." It is given to few men to stand athwart a myth and lay it low, but G. Warren Nutter did exactly that, and almost single-handedly, when he published, at the age of 39, as the result of 15 years of work, his fine study, *The Growth of Industrial Production in the Soviet Union* (Princeton, 1962). Although Professor Nutter went on to serve as advisor to Barry Goldwater in 1964 and Richard Nixon in 1968, as Assistant Secretary of Defense from 1969 to 1973, and as chairman of the Economics Department at the University of Virginia, he knew that that 1962 book was his *magnum opus*. Asked, shortly after publishing it, whether he was working on another such, he smiled his warm and decent smile and said, "Oh, no, you only do one of those in a lifetime."

That lifetime closed on January 15—cancer—and we extend to his widow and their four children our most earnest condolences. And our continuing condolences to the country he served so honorably, for it is still in the grip of the myth-makers and truth-suppressors. The *New York Times* devoted nine column-inches to the obituary notice and never mentioned the title of Nutter's greatest work, or indeed any of his works.

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Notes & Asides

■ Dear Mr. Buckley,

Gene Genovese, Editor of *Marxist Perspectives*, sings the praises of NATIONAL REVIEW as a model of popular political journalism. The efforts of those of us who work in the office of *MP* to keep track of the enemy would be aided by a comradely (whoops . . . collegial) exchange of subscriptions. I hope you will look favorably upon my modest proposal.

Cordially,
Jacques Marchand, Publisher
Marxist Perspectives
New York, N.Y.

P.S. Our list of subscribers includes several *NR* staff members. While I welcome such august converts, I assure you we have not yet placed moles in your organization.

Dear Mr. Marchand: If you have, you can fire them for incompetence. Cordially, WFB

■ Dear Mr. Buckley:

Question: What was the nickname given to economists Milton Friedman, George Stigler, and the late Harry Johnson when all of them were at the University of Chicago?

Answer: The Free Marketeers.

Very truly yours,
Calvin T. Sun
San José, Calif.

P.S. Please, don't cancel my subscription.

Dear Mr. Sun: Okay. But it was close. WFB

■ Dear Mr. Buckley,

Some illuminations contained in your neat organ hit me with the surprise of a stabbing ice pick for which I am utterly unprepared. I love it.

Sincerely,
Gordon Field
Saunderstown, R.I.

Dear Mr. Field: Thanks, I think. WFB

■ Dear Mr. Buckley:

Will there be a banana in 1979? Probably not, but there might be a pineapple in 1980 and, God forbid, even a watermelon in 1981.

Unless, that is, the dispute between the Senate and the President vis-à-vis Taiwan and the PRC leads to such a rhubarb that everything ends up in a big pickle before the new Congress has a chance to survey orchard and garden.

Stuart Chase, where are you now that we need you?

Sincerely,
W. D. McLean
Ann Arbor, Michigan

■ Dear Mr. Buckley:

I note Tom Wendel's letter and enclosure of Ben Franklin's plan for a striking sundial. Very funny, except for one thing. Never underestimate the power of twentieth century merchandising.

That is, and to wit, if you look at page 13 of Hammacher Schlemmer's Christmas catalogue, you will find this very thing, all nicely made of brass, and selling for a mere $125. Of course, this is for only one cannon, firing at high noon. But of course, any reasonably well-heeled person could order 78 of these, as Franklin states, and there you have it. It will cost less than $10,000, and be a status symbol of sorts.

Better hurry, before the gun-control people get their eyes on this one.

Sincerely,
John S. Carroll
Emlenton, Pa.

■ Memo to: WFB
From: J. P. McFadden

Additional copies of this special issue are available —while our supply lasts—at the $2.00 cover price; 100 or more copies at $1.00 each. We will pay all postage and handling. Write to Dept. R., NATIONAL REVIEW, 150 E. 35th St., New York, N.Y. 10016. Please enclose payment with order.

■ Note to our readers:

The editing of this issue is substantially the diligent and ingenious work of Richard Brookhiser, who wrote his first article for NATIONAL REVIEW in 1970. He was then 14 years old. He came to NATIONAL REVIEW during the summer of his junior year as a summer editorial assistant, and then joined the staff upon graduation. At Yale, where he majored in English, he graduated summa cum laude. His record was marred by two Bs, obviously from vindictive left-wing professors. (Every other grade he received, over a period of four years, was A.) His name has by now become familiar to readers of the magazine, for which he has written probably more in the months since his arrival on the staff than any other writer. The editors of NATIONAL REVIEW take great pride and pleasure in announcing his election as a Senior Editor. At age 23, he considers himself a late-achiever.

—WFB

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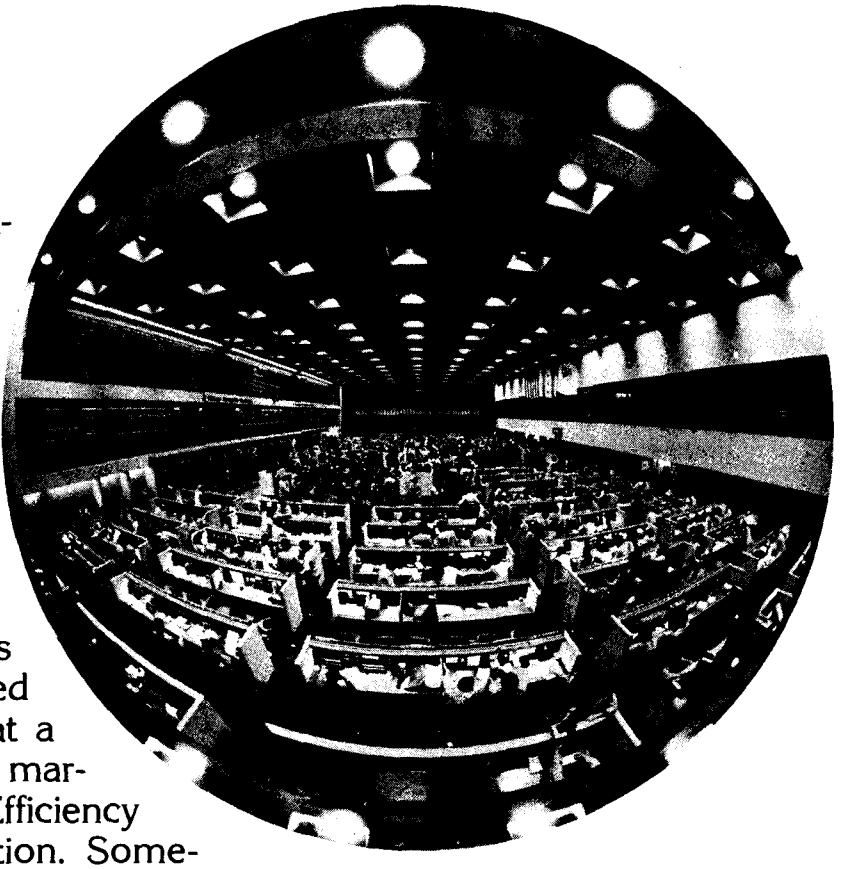

Here's a statement that's frankly hard to believe: futures trading on the Chicago Mercantile Exchange tends to reduce costs to consumers while increasing profits to efficient producers.

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Understanding a Trillion-Dollar Question

RICHARD BROOKHISER
interviews
BERNARD L. COHEN

NR: Professor Cohen, the fight over nuclear power is relatively new, though nuclear power is not. How long have we had nuclear power?

A: The first U.S. reactor built for producing electric power was the Shippingport, Pennsylvania reactor which began operating in 1957, during the time of the Eisenhower Atoms for Peace program. There are now 151 operating power reactors in foreign countries; in the United States, there are seventy-two.

Q: How much of our electricity do they generate?

A: They represent a little less than 10 per cent of the total U.S. generating capacity; but since they run more of the time than most plants, they generate about 12 per cent of all our electrical energy.

Q: Why do they run more of the time?

A: Some other types of electric generators are used only for peak loads; but nuclear reactors are built to run nearly continuously.

Q: Does this mean they're more dependable?

A: It's more a reflection of the fact that their fuel costs are much lower. As for dependability, they're as dependable as any other type of plant, coal- or oil-powered. Of course, that's the advantage of diversity. At times when there is difficulty with coal, as in the coal strike, or during a very cold winter when coal piles freeze and barges can't move on the rivers, nuclear plants can run full out, which is an important service.

Q: How many kinds of reactors are there?

A: There are two basic types in the United States. These are boiling-water and pressurized-water reactors, and they differ only in details. Both consist essentially of enriched uranium, surrounded by water. With this set-up you can have a self-sustaining chain reaction that generates a lot of heat, so that as you pump the water through, it gets heated. The hot water is then used to make steam; the steam drives a turbine; the turbine turns a generator; and that produces electric power.

Q: What do you mean by "enriched uranium"?

A: Uranium appears in two forms, U-235 and U-238. The first is useful in chain reactions; the second is not. The uranium that comes out of the ground is 99.3 per cent U-238, and 0.7 per cent U-235. For the sort of reactor I have just described, you enrich the percentage of U-235 to 3 per cent.

Q: And all commercial reactors today use this mixture?

A: That's right, with small variations.

Q: Don't some reactors use plutonium?

A: Plutonium is generated as reactors operate and most of it is consumed as fuel without human intervention. Plutonium could be substituted for uranium as the input fuel in present-day reactors; in fact, it's been done on a small scale. But the most efficient way to use plutonium is in a fast breeder reactor—which has the great advantage that it produces more fuel than it consumes.

Q: Explain.

A: Fast breeders contain a mixture of plutonium and U-238. Neither of these materials is rare or expensive—plutonium can be extracted from the waste of uranium reactors; while U-238 is what's left over after the uranium enrichment process.

There are two processes which occur inside a fast breeder reactor, one involving the plutonium, and the other involving the U-238. When a neutron strikes a U-238 nucleus, the uranium turns into plutonium. When a neutron strikes a plutonium nucleus, both the neutron and the plutonium nucleus are destroyed in a fission reaction. But each of these plutonium reactions produces an average of 2½ new neutrons. One of these neutrons is needed to replace the original neutron that started the reaction; but that still leaves an average of 1½ neutrons, which can produce 1½ new plutonium nuclei by striking U-238 nuclei. Look at it this way: one plutonium nucleus has been destroyed—but 1½ have been created. So that, obviously, more plutonium fuel is produced than consumed.

This is a very efficient way to use fuel. In fact, we could

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get all the United States' electric power for several hundred years from the U-238 which is now sitting in barrels in government storage areas.

Q: Are there any fast breeder reactors operating in the world today?

A: Yes. The French are probably furthest ahead on this. They have the Phénix, which is one-third the size of the largest power plants we are now using; and they're beginning to build the Super-Phénix. The Russians are about as far along as the French; they have a Phénix-sized plant in operation. The British also have a comparable plant which recently began operation. Several other countries have made smaller efforts in that direction, including Germany, Japan, Italy, and Belgium.

Q: When could *we* start making them?

A: There is a considerable roadblock: President Carter has delayed the project.

Q: Okay, suppose he hadn't.

A: The original plans were for the Clinch River fast breeder reactor to be ready by 1981. Of course, stopping an operation of that type is not an easily reversible process. You can't start it up the next day: a lot of savvy people have got other jobs and can't be brought back overnight; the whole program loses momentum. Fortunately, the Clinch River project has not been cut off entirely. They are getting $170 million for fiscal year 1979 and it has been several months since any of their important people have left to take other jobs. So it may be that all of Carter's tactics will not delay the project by more than a year or so.

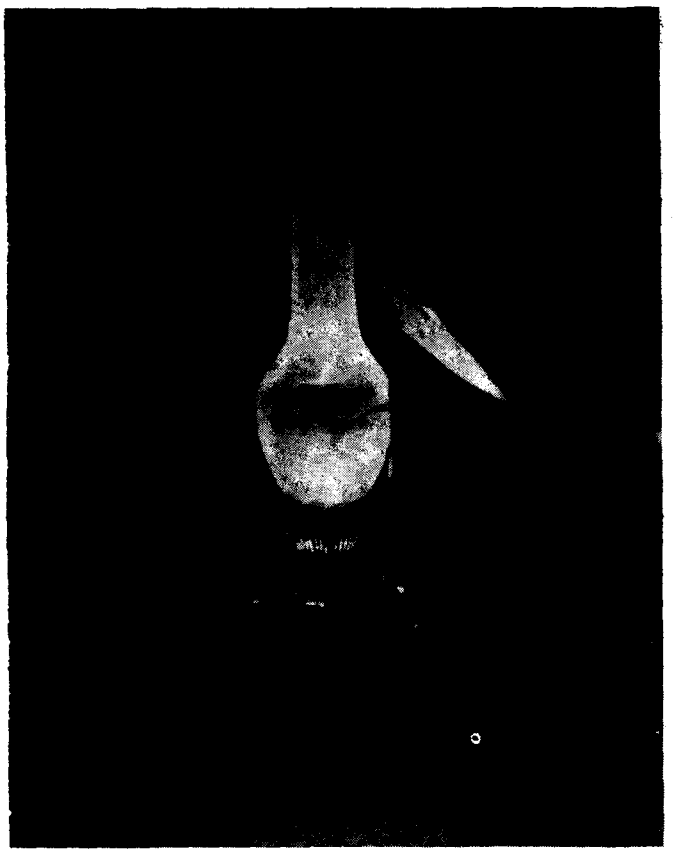

Photo by Jan Lukas

Q: We've been talking about fast breeder reactors. Is there such a thing as a *slow* breeder?

A: There is another possible type of breeder, known as a thermal breeder reactor, which uses a mixture of thorium and U-233. It's extremely difficult, though, to make more fuel than you're burning up with this reaction. Admiral Rickover claims to have an experimental reactor at Shippingport which is making a tiny bit more, but this remains to be seen. If it *is* making more fuel, it's only 1 or 2 per cent more.

Q: If the thermal breeder is impractical and the fast breeder is being delayed, then we must continue to rely on uranium-fueled reactors—in which case it's important to know how much uranium we have.

A: This is a matter of considerable uncertainty. The most common opinion is that we could continue to build reactors of the type we're using now for the rest of this century, and still guarantee each reactor a thirty- to forty-year supply of uranium fuel from American sources at reasonable cost. The pessimists believe we can't do this past 1990—that we would run out of uranium—while the optimists believe we can do it until 2010. The optimists' estimate is the main reason cited by the President when he stopped the Clinch River fast breeder; but if it happens that the pessimists are correct, we'll be running short of uranium by 1990. In which case we should be going full speed ahead with the fast breeder now.

In my view, we should build the Clinch River breeder if only as an insurance policy—in case the pessimists prove correct. If we do that and it turns out that we have a lot of excess uranium, some money will have been wasted. But that's the way insurance works. When we buy an insurance policy, we *hope* to lose money; we buy it for protection, not as a money-making investment.

Safety

Q: All right. Now obviously, whether we're discussing uranium-fueled reactors or fast breeders, we're talking about very powerful devices; and one thing that worries many people is whether one of these things could blow up.

A: It is physically impossible to have a nuclear explosion in a uranium-fueled reactor. The uranium enrichment needed for a bomb is very much greater than the 3 per cent enrichment needed for reactor fuel. There's *nothing* you can do with that fuel to make it blow up.

There could be a very small nuclear explosion in a fast breeder. "Small," in this context, is not a euphemism. Nuclear explosions come in all sizes; you could devise an energy release large enough to destroy a city, or small enough to blow open a door. All studies so far indicate that the worst explosion you could have in a breeder would not be enough to break through the walls built around the reactor (especially the "containment") or to release any radioactivity into the environment.

Q: If bomb-blasts are impossible, then what is the worst that could conceivably happen?

A: The thing that people worry about most is what's called a melt-down accident. The water that passes through a re-

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actor reaches extremely high temperatures and pressures. If a pipe were to break, opening up a very large hole, this super-hot water would all come pouring out of the system. If that should happen, the chain reaction would be arrested, since it needs the water in order to continue. But you would be left with the radioactive waste products in the reactor, which are still hot. In fact, their radioactivity produces 6 per cent of the heat in the reactor while the chain reaction is going on. If the water were lost, then enough heat would be generated by these waste products to melt the fuel itself, thus releasing some of the radioactivity in the form of airborne radioactive dust. If people inhaled this dust, or were exposed to it externally, there could be very high radiation exposure.

Q: How ominous is the worst conceivable melt-down?

A: Bad. That is why there's been a tremendous amount of engineering and research devoted to making as sure as possible 1) that the water system will not burst open; 2) that if it does, you won't have a melt-down; and 3) that if you *do* have a melt-down, the consequences will be limited.

In the first place, all the items used in the reactor are built to higher standards than have ever been used in industry before. There are elaborate inspections at all stages of fabrication, and even after the reactor is in operation there are periodic shutdowns for further inspection.

Another level of protection is provided by leak detectors. Since large leaks ordinarily start out as small leaks, there are several safety systems built around each reactor to detect small leaks should they occur. These systems are extremely sensitive. One of them detects humidity—if even a small leak developed in a water pipe, steam would come shooting out; this would be instantly registered. A second system detects radioactivity—the water in the reactor becomes radioactive, and the radioactivity coming out of any leak would attach itself to dust particles in the air. There are two different methods of measuring the amount of radioactive dust in the air around the reactor. Incidentally, as a historical matter, such a leak has never occurred. In 1975, they found hairline cracks in a few reactors by visual inspection, in pipes which, however, were *not* part of the main system. These were routinely repaired. But there has never been a leak significant enough to trigger these safety systems, which are calibrated to detect leaks many times smaller than any that would be likely to cause trouble.

And finally: if, in spite of all these precautions, the system did mysteriously burst open, there is an emergency core-cooling system, which gets water into the reactor core to cover the fuel and stop the reaction. This is a highly redundant safety system; each part has back-ups, and no failure of a single valve or motor or pump would stop it from delivering its water.

Q: And the point of this is to cool off that fuel?

A: To get the fuel covered with water. Once you do that, there's nothing to worry about.

Q: Wouldn't that start the reaction up again?

A: No—there are control rods which would automatically be inserted into the core, which would stop the reaction. In addition, the freshly pumped-in water contains boron, an element which prevents the reaction from starting up again.

If, for some reason, the emergency core-cooling system did not prevent the fuel from melting, all the radioactivity in the reactor would still be confined in a very powerfully built structure called the containment. Containment walls are made of reinforced concrete, three feet thick; the reinforcing rods are the diameter of beer cans, all welded together in a net; in fact, to get the concrete in, they had to develop special techniques for pouring concrete. The containment is also lined with steel plate.

This containment gives a lot of protection against external forces. For example, you could explode any amount of TNT or nitroglycerine against the containment wall and it wouldn't fracture. Anything a tornado could throw against it—like a house, an automobile, a tree—would just bounce off. A conventional bomb dropped from an airplane would not penetrate it. But in the melt-down scenario we're discussing here, its function is to protect against internal, not external forces: to contain the radioactive dust for at least several hours.

If it can do this, then there are several types of equipment inside the containment for getting the radioactive dust out of the air. One type acts like a large vacuum cleaner; another consists of chemical-containing water sprays, which would neutralize some of the most important types of radioactivity. Also, just being confined inside the structure gives most of the radioactive material time to "plate out"—to attach itself to cool surfaces, thereby removing it from the air.

The only real problem would be if the containment were somehow to burst open immediately after the melt-down. If that happened, a lot of the radioactive dust would get out into the environment. In most cases, even then the radioactivity would be widely dispersed and things wouldn't be too bad. However, if there happened to be a temperature inversion, keeping the dust in a dense cloud close to the ground, and if the wind were blowing toward a densely populated area, then the consequences could be quite severe —3,500 early fatalities, according to a government study known as the Rasmussen Report. In addition, over the next fifty years you would expect something like 45,000 additional cancers in a population of ten million people. On the other hand, the chances of such an accident were estimated at one in a billion reactor-years.

Q: We'll get back to the Rasmussen Report; but before we do, I wanted to raise a question about the emergency core-cooling system. Critics have been claiming since 1971 that it wouldn't work; how has that issue been resolved?

A: We've never had a leak in a reactor, let alone lost the coolant, let alone had a melt-down, let alone challenged the containment—so it's hard to say. Of course the emergency core-cooling system has not been tested under real conditions. Back in 1971, the first tests on it using very simplified prototypes did not seem to work out as expected, which was interpreted as meaning that the emergency core-cooling system might not work to save the reactor in the event of a very large leak. This stirred a great deal of controversy, and the old Atomic Energy Commission held hearings in Bethesda, Maryland for over a year on the subject. Eventually it was decided to introduce some supplementary precautions into the designs; and in some reactors, this meant reducing the amount of power they were allowed to generate. It required redesigning the fuel rods in some cases, to provide more surface area for quicker cooling. Since then

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there have been about fifty successful tests on prototypes.

None of these tests has been on large reactors, however, and so a much more realistic series of tests has begun near Idaho Falls, on a reactor built especially for the purpose, known as the LOFT reactor (LOFT = Loss of Fluid Test). In the first trial, last December, the emergency core-cooling system cooled the reactor much more effectively than had been predicted.

Q: Let's return to the predictions for the worst accident.

A: According to the Rasmussen Report, one would expect this "worst accident" once in a billion reactor-years.

Q: And if the United States were to get all its electricity from reactors, that equals—

A: Once in three million years in the United States.

Q: People have criticized those estimates?

A: Yes, and many of their criticisms were incorporated in the final version. In 1973 the Atomic Energy Commission organized an elaborate project to study reactor safety. Professor Norman Rasmussen of MIT headed the study. A draft came out in 1974 and went through 16 months of public review. The final draft appeared in 1975, after two years and $4 million.

Among those who remained unsatisfied was a group which calls itself the Union of Concerned Scientists, which is the scientific advisory group to Ralph Nader. This group came out with a report in December 1977, giving its own analysis of the situation; and it concluded that the Rasmussen estimates were too small by a factor of one hundred.

Q: In other words, there would be one "worst accident" every thirty thousand years.

A: It's not that simple. They said the accidents would be ten times more frequent, and the effects ten times worse.

Now let's put this in perspective. If you accept the government estimates, and average them out over time, it turns out that if nuclear reactors supplied all the electric power in this country, thirty minutes would be taken off the average person's life expectancy. This equals the risk of smoking one cigarette every twenty years. If you accept the Union of Concerned Scientists' estimates, then all-nuclear power would take two days off the average person's life expectancy, which equals the risk of smoking one cigarette every three months.

An important point here is that even if you accepted the critics' estimates, nuclear energy is still ten times safer than coal. The way the Union of Concerned Scientists put it was this: If we had a very vigorous nuclear power program in this country, we might have 15,000 fatalities by the end of this century. What they left out is that we now have something like 15,000 fatalities every *year* from burning coal, which is our only alternative to nuclear energy.

Let me give you some other comparisons. You can add ten days to your life expectancy merely by putting smoke alarms in your home. Putting an air-bag in your automobile adds fifty days. Owning a small car rather than a standard-sized car takes fifty days off your life expectancy—which makes small cars at least 25 times more dangerous than nuclear power plant accidents—and that's the figure only if you believe the estimates given by nuclear critics. Finally, if you accept the government estimates, the risk of nuclear accidents equals the risk faced by an overweight person

Foreign Countries with Nuclear Power Reactors

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"Mankind has never handled as dangerous a commodity as plutonium. We have never developed the skill."—Charles Thornton, former director of Nuclear Materials Safeguards, AEC

who gains an additional 1/100th of an ounce. If you use the critics' estimates, it's one hundred times worse—so every ounce an overweight man gains represents as much of a drain on his life expectancy as a comprehensive nuclear power program.

Q: Will fast breeders be equally well protected against melt-downs?

A: You can't have a sudden loss-of-coolant accident in fast breeder reactors, since they are cooled with liquid sodium, which does not have to be pressurized. If a pipe broke, you would get a trickle of liquid, not a flood. A melt-down might happen in other ways—if, for instance, a pipe were somehow blocked. But the experts are confident that they know how to build a fast breeder which is at least as safe as present-day uranium-fueled reactors.

Q: If it's so safe, why can't people get nuclear clauses in their insurance policies?

A: The insurance for nuclear power is covered by what's called the Price-Anderson Act [see also "The Price of Power," by Milton R. Copulos, p. 156], which set up a special no-fault insurance under which liability coverage up to $150 million is purchased from private companies, and additional coverage is provided by special assessments against nuclear plants, and by federal guarantees. Total liability for a single accident is limited to $560 million, increasing to about $1 billion by the mid-1980s.

Q: Why was it done this way in the first place?

A: The worry was that small companies—say, a company that makes valves—would not want to sell parts for use in a nuclear reactor, for fear that if there were an accident they would be held liable for very large sums of money and be wiped out. This insurance was therefore provided as a substitute for all other coverage.

Sometimes people say insurance companies are not willing to risk their money on nuclear power plants. Actually, insurance companies are already risking a great deal of money. They have more to lose from a nuclear accident than from any other type of accident. They stand to lose $250 million, including the insurance on the plant equipment, which is as much as they feel they're willing to risk on any one event.

Q: What is the nuclear industry's record so far?

A: There has never been a member of the public injured by radiation in an accident in any phase of the nuclear industry.

Q: What about people working in the industry?

A: There have been seven deaths in research laboratory accidents, but none in the commercial industry. Of course, people fall off ladders, as in any industry; but the commercial industry has never had a fatal nuclear accident.

Q: What about close calls? Reader's Digest Press issued a book whose title suggests that we almost lost Detroit.

A: That was a real mis-title. The accident in question happened in an experimental reactor of a type different from the reactors we use now. There is nothing that could have possibly happened in that reactor that could have done harm to Detroit. The reactor was just starting up, so there was very little radioactivity in it; and even if, by some unimaginable set of circumstances, all the radioactivity that was there had gotten out into the environment, nobody in Detroit would have been injured. The operators shut the reactor down without difficulty, repaired the damage, and started it up again some months later.

Q: What about Brown's Ferry, Alabama?

A: The accident at Brown's Ferry was the nearest thing there has ever been to a nuclear accident in the U.S. nuclear power program—or anywhere else in the free world, as far as we know. In 1975, they had a fire at Brown's Ferry which caused a loss of electric power. So the water pumps didn't work—and the cooling water in the reactor began to boil away. If this had gone on for very long, the fuel would have been left without coolant, and there could have been a melt-down. As it turned out, the operators found a way to get water back into the reactor in

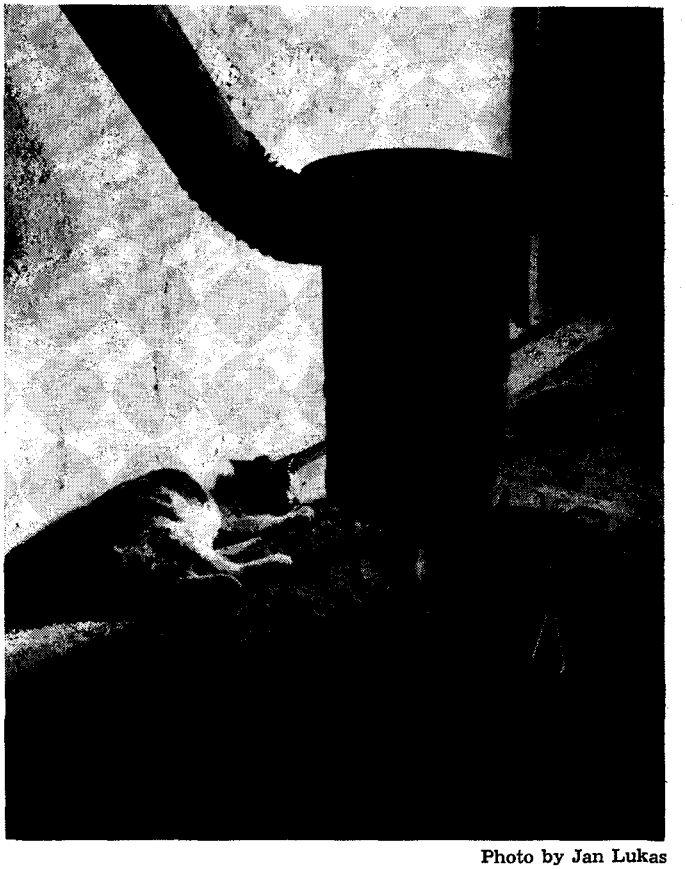

Photo by Jan Lukas

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about half the time they had available (several hours). However, as in all reactor accidents, an important lesson was learned. Ever since, a great deal more attention has been paid to fire protection. It's now virtually impossible for anything like that to happen again.

Q: We've been talking so far about the safety features of the plants themselves; but of course they are only part of a long fuel cycle. Fuel and waste have to travel back and forth over long distances. Suppose there was a crack-up involving a truck carrying radioactive material. What safeguards do we have?

A: Highly radioactive materials are transported in special casks. These casks cost $2 million apiece, and you can imagine that if you're willing to spend $2 million on a cask, you can make sure that the stuff inside doesn't get out. These casks have been tested by crashing them into solid walls at eighty miles per hour, and by hitting them with speeding railroad locomotives; they've been immersed in gasoline fires for thirty minutes, followed by submersion in water for eight hours. But even if they did break open, practically all the radioactivity is imbedded in ceramic materials. The only way to get much of it out would be to melt *them*, and they would not melt at the temperatures that could be generated in a transportation accident fire.

Health

Q: We've discussed pretty thoroughly the hazards of accidents; let's get into the risks of normal operation. How much do we know about the effects of nuclear radiation?

A: Radiation is probably the best understood of all insults to our environment. It's much better understood, for example, than such things as air pollution, food additives, insecticides, or herbicides. In the first place, it's a very simple phenomenon, much simpler in its effects than chemical poisons. In the second place, it's been studied very thoroughly. Scientists tend to attack simple problems; and the old Atomic Energy Commission sponsored $2 billion worth of research on the health effects of radiation. Also, it's easy to measure—there are simple, cheap instruments that can detect and accurately measure amounts of radiation a million times smaller than any that would do you harm.

Q: Yet in spite of all that, there have been claims that our understanding is deficient?

A: Yes, there have. But most of these came out of the so-called Mancuso study. Mancuso, Stewart, and Kneale were three researchers with a contract from the Energy Research and Development Agency. In late 1977 they reported that there had been an unusual number of cancers among workers at one of the government laboratories. Their work was given a tremendous amount of publicity. On careful scrutiny, there were all sorts of problems with it. At least 15 separate critiques have appeared, and their work has been judged inapplicable by the International Commission on Radiation Protection, the Nuclear Regulatory Commission, and the United Kingdom National Radiological Protection Board.

Q: How *should* we evaluate the radiation from nuclear plants?

"We routinely handle far more dangerous substances: our present annual production of hydrogen cyanide could cause six trillion deaths."—Samuel McCracken

A: In normal operation, nuclear power plants emit less radioactivity than coal-burning plants. It turns out that coal contains a small amount of uranium; and when the coal is burned, the uranium and some of its associated products (like radium) are spread without control all over the landscape. This turns out to be more of a radiation hazard than radioactive materials emitted from nuclear power plants.

Another way to judge it is this: If all our power were nuclear, and if you considered the whole nuclear fuel cycle —making the fuel, using it, and reprocessing it—then the total effect of all such radiation would be equal to the risk of smoking one cigarette every twenty years, or of an overweight person's adding 1/100th of an ounce to his weight.

Q: I thought those figures equaled the risks from nuclear accidents.

A: They do. It happens that the Rasmussen Report estimates of accident effects are equal to widely accepted estimates of the effects of radioactivity.

Q: It's just a coincidence then.

A: Right. On the other hand, you'll remember that there was a controversy about accidents, and it was claimed that accident risks were actually one hundred times worse than officially estimated. But there have been no such claims about routine emissions, apart from the Mancuso paper.

Of course, mankind has always been exposed to natural radiation. There are cosmic rays coming down from outer space. There's radioactivity in the ground; all rock contains uranium, thorium, and potassium, which are naturally radioactive. We get bricks and building stones from the earth, and therefore these materials also contain radioactivity. There is radioactivity in our bodies. Potassium is naturally radioactive, and we have to have potassium to live. And then there's naturally radioactive radon gas in the air we breathe; every time you take a breath, you're inhaling radioactivity. Now, each of these sources—the cosmic rays coming down from above, the radioactivity coming up from the ground, the radiation in our building materials, the radiation in our bodies, the radiation from the air we breathe—each one of these sources gives us at least a hundred times more exposure than we would get from the routine emissions of nuclear power plants if all our power were nuclear.

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Medical X-rays are a relatively new source of radiation, just begun in this century; and the radiation the average American gets from medical X-rays is several hundred times higher than the radiation he would get from power plants if all our power were nuclear.

Now, of course, there are variations in all of these generalities. Some buildings are made with more highly radioactive material than others. Grand Central Station, for example, is made of a granite that has a large amount of uranium. The Congressional Office Buildings are also constructed of high-uranium granites. As a result, you would get as much extra radiation from spending six months in these buildings as you would in a lifetime from having all our power nuclear.

The natural radiation in some areas is also much greater than in others. In Colorado, the natural radiation level is twice the U.S. average. So the extra radiation you would get from spending six weeks in Colorado would be more than the radiation you would get in your whole life if all our power were nuclear.

Q: What about plutonium? If we decide to process plutonium from the waste of our uranium reactors, in order to supply fast breeders, we're obviously going to have a lot of plutonium moving about the country. It's been called the most toxic substance known to man.

A: It *is* fairly toxic—about as toxic as nerve gas, if you inhale it as a fine dust. But it's not the most dangerous material known to man by any means. As the author of a widely quoted scientific paper on plutonium toxicity, I was accused by Ralph Nader of trying to detoxify plutonium with a pen. In reply, I offered to inhale a thousand times as much plutonium as he claims would be lethal, and to eat as much plutonium as he would eat caffeine. My offers have been ignored.

Sometimes you hear the statement that a single particle of plutonium getting into your lungs could kill you. This is not true, for the simple reason that large particles can't get into the lungs. Your body has all sorts of protective mechanisms to keep them out. If you consider the largest particles that can get into your lungs, it would take some tens of thousands of these to give you an appreciable risk of getting cancer.

Q: How easily do small particles of plutonium float in air?

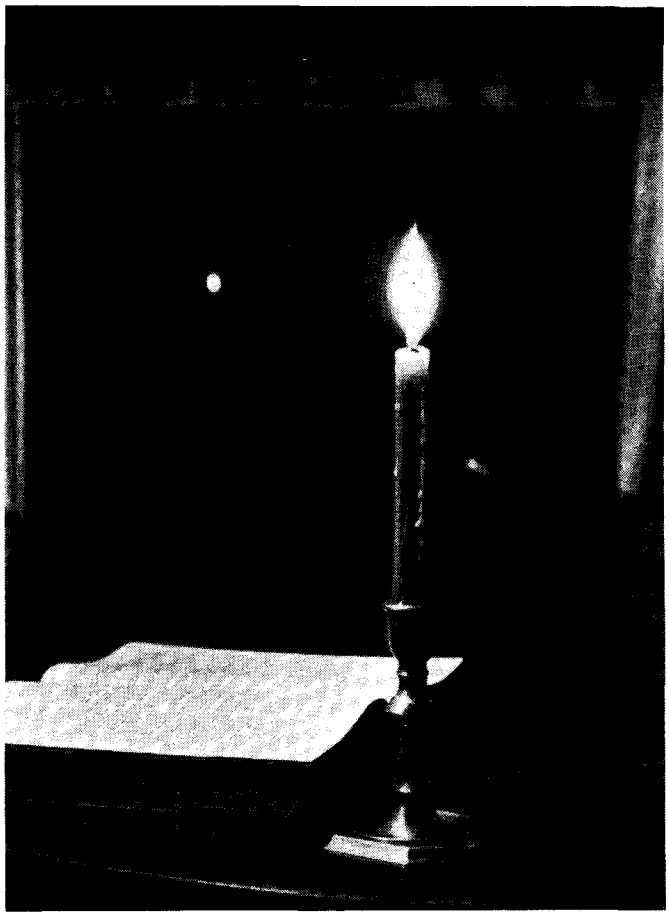

Photo by Jan Lukas

A: Not very easily. For example, if you opened a box of plutonium powder and blew on it with an electric fan, virtually none of it would get into the air as a dust you could inhale. Incidentally, the information about plutonium toxicity comes from experiments with animals in which they have had great difficulty getting the plutonium into the air in such a way that the animals could breathe it. No human being has ever been injured by plutonium toxicity.

Q: Doesn't the hot-particle theory of plutonium dispute these claims?

A: The hot-particle theory was proposed by two professional nuclear critics, not as a scientific paper, but as a legal suit asking the regulatory agency to reduce allowable exposure to plutonium. The theory was studied by various groups throughout the world, and rejected by all of them, including a special committee of the National Academy of Sciences, the National Council on Radiation Protection, the British Medical Research Council, the United Kingdom National Radiological Protection Board, the United States Nuclear Regulatory Commission, and the old Atomic Energy Commission. The International Commission on Radiation Protection and the Environmental Protection Agency have also rejected it by implication in not changing their exposure standards, which are based on the conventional theory.

Q: Why do these gentlemen persist?

A: I don't know that they have. They certainly haven't published the theory in any scientific journal, although they haven't retracted it either, and the press and opponents of

"The inescapable fact [is] that the Industrial Era is rapidly drawing to a close."
—Edward Goldsmith, editor of the *Ecologist*

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nuclear power continue to assume that the theory is valid.

Q: Pollution doesn't have to consist of particles, hot or otherwise. There is thermal pollution, for instance. Is nuclear power more likely to cause that?

A: Thermal pollution occurs when hot water is discharged into rivers, thereby affecting aquatic life. All power plants —coal, oil, gas, or nuclear—discharge hot water; nuclear plants put out somewhat more than the others.

There is a technological solution to the thermal-pollution question, and that is to build cooling towers, which add something like 5 per cent to the cost of the plant, and which virtually eliminate the problem. This is now being done; so, effectively, thermal pollution is no longer an issue.

Q: Uranium mining has been called "the costliest portion of the fuel cycle." What is the problem there?

A: There are two problems with uranium mining. First, a lot of the miners got lung cancer from exposure to radon gas in the mines. But this problem was very easily remedied by increasing the ventilation in the mines, and the miners' exposure to radon has been greatly reduced. It should be understood, by the way, that uranium mining has never been nearly as dangerous as coal mining.

The other problem with mining is that some waste products (called "mill tailings") are left on the surface, where they release radon gas—which, over the next several centuries, could do an appreciable amount of harm. This problem is now being addressed. The technological solution is rather simple and cheap—the tailings are covered with materials that stop the gasses from coming out. Taking care of the mine waste problem increases the cost of nuclear electricity by 1/20th of 1 per cent.

Q: Fuel waste, I gather, is not so easily disposed of. How dangerous is this waste?

A: It depends. If you fed it to people, it would be quite dangerous. There would be 100 billion potentially lethal doses in one year's nuclear waste, if all of our power were nuclear. This compares with the 400 trillion lethal doses of chlorine gas that this country produces every year.

Perhaps the most instructive way to understand the waste from nuclear plants is to compare it with the waste from coal-burning plants. When you burn a fuel, material doesn't just disappear. It's converted into other forms, which we call waste. With coal-fired power plants, these wastes escape as air pollution. With nuclear plants, the wastes don't escape. They're left in solid form, such that we can take care of them.

Another difference between the kinds of waste is quantity. The waste from a coal-burning plant is five million times larger by weight than the waste from a comparable nuclear plant, billions of times larger by volume. The waste produced by a large nuclear power plant in one year would fit under your dining room table. The power plant that produces that waste generates power worth something like $200 million. That means you could afford to spend a couple of million taking care of a block that could fit under a table, without increasing the cost of electricity by more than 1 per cent. And that's roughly the plan—to spend a couple of million dollars to take care of this small amount of waste.

Now, sometimes people complain that they don't want waste being dumped in their neighborhood. And from this, you conjure up an image of a truck driving up, tilting back, and dropping a load down into a hole somewhere. Clearly, it wouldn't cost $2 million to do that with something that would fit under your dining room table; and what's being planned for nuclear waste is much more elaborate. Present thinking is that the best way to dispose of it is to convert it into a glass or ceramic and bury it deep underground in some carefully chosen rock formation.

Q: Aren't we contaminating the earth by doing that?

A: The ground is full of natural radioactivity already, and by putting our waste down there, we're just increasing the radioactivity in the ground by something like one part per million. The radioactivity in the ground—except for that which is within a few feet of the surface—is doing very little harm; and it can be shown that it's not causing even one fatality a year in the United States. So adding to it by one part per million is not very likely to do any harm.

Indeed, people who worry about effects over hundreds of thousands of years might take heart from the fact that in using nuclear power we are burning up uranium, which is responsible for a lot of the natural radiation exposure we're talking about. After a few hundred thousand years, the number of lives we save by burning up this uranium is a hundred times larger than the number of lives we would stand to lose through problems connected with the waste. In other words, people living hundreds of thousands of years from now will be exposed to less radioactivity as a result of our use of nuclear power today.

Q: That's the long term; how dangerous is the waste at the time it's buried?

A: At first, it's extremely toxic—1/1000th of an ounce would probably kill you. But after a few hundred years, you would have to eat a quarter-pound to have your health affected. Now that's not, actually, very toxic; there are many things we keep in our homes, and there are natural rocks in the ground, like cinnabar, of which one ounce would be enough to kill you. So the danger of buried waste divides into two problems—a short-term problem which lasts for a few hundred years, during which the waste is quite toxic; and a long-term problem, which goes on for hundreds of thousands of years.

What scientists worry about most is that, somehow, buried waste will come into contact with ground-water, and will be dissolved, carried through the ground with the water,

"For most people in most societies, growth is the way out of such miseries as hunger, disease, and illiteracy."
—Richard Rovere

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and eventually be brought into food and water supplies. To prevent this, the waste will be buried in a rock—probably salt—in which there is negligible ground-water, and in which geologists are as certain as possible that there will be no ground-water for a very long time to come.

If water does get into this formation, it will have to dissolve a large fraction of the surrounding rock before it can get to the waste. Since salt is soluble in water, you might think a salt formation would give the least protection; but in at least one rock formation being considered, there's so much salt and so little water that if all the water flowing through the ground in that area were diverted to flow through salt, it would take fifty thousand years to dissolve away the salt enclosing one year's waste.

If the water should somehow get to the waste, which would be in the form of a glass or ceramic, it would take a very long time to dissolve it. Pieces of glass from Babylonian times have been found in rivers, where water has been washing over them for thousands of years without dissolving the glass.

Finally, if the ground-water should dissolve the waste, it would typically take a thousand years for water from that depth to get back to the surface. The radioactive materials would move hundreds of times more slowly, since various mechanisms would filter them out as they passed through the rock. So these things give many layers of protection for the first few hundred years, when the waste is very poisonous.

Q: What happens then?

A: As I've said, after a few hundred years the waste ceases to be especially dangerous. After five hundred years, the radioactivity in nuclear waste is only a few times more hazardous than the radioactivity in the uranium from the wastes of a coal-burning plant; after a few thousand years, the coal plant waste is more dangerous. Don't forget also that the nuclear waste is buried deep underground, while the coal wastes are scattered over the surface without any control or containment.

The chances of this waste getting out even after a few thousand years are fairly slim. The "life expectancy" of a typical rock buried two thousand feet below the surface can be estimated in various ways, and it turns out to be something like fifty million years. If the waste behaves like a typical rock, then the probability that an atom of waste will escape and get into a river is something less than one chance in fifty million per year. Once it gets into a river, we may presume it will behave more or less like other materials in rivers, which means that it has less than one chance in ten thousand of finding its way into human food or drink. When these probabilities are multiplied together, it turns out that if all our electric power were nuclear for a million years, the accumulated waste would cause less than one fatality per year in the United States.

Q: There was a problem, though, with one of the waste disposal sites, a salt mine in Lyons, Kansas. Didn't it turn out that it wasn't as good as they thought it would be?

A: The problem there was that we changed our minds on how good we expected it to be. In the 1960s, it was deemed sufficient merely to put waste in an abandoned salt mine. We could have done better than that, but that was a cheap and easy solution which, to this day, knowledgeable people continue to feel was perfectly adequate. However, when the public became worried about the waste problem, it was decided to seek a more certain solution. You should not get the idea that if they had gone through with the plan, there would have been a catastrophe. It's just that we can do better at higher expense, and with all the public concern, it's worth the extra expense to do better.

For example, the Lyons mine could have been used to store all the waste generated in this century at a total cost of $50 million, whereas this year alone we are spending $250 million on the waste problem.

Q: Would there be any point in terrorists digging these things up? Could they, or would they want to?

A: It would be very dangerous to the terrorists, and there wouldn't be much harm they could do with it. In order to do much damage, they would have to disperse it very widely, and it takes fifteen to fifty years before people's health would be affected by it. So if terrorists want to kill a lot of people, they can certainly do so much more effectively than by using radioactive waste.

Crimes and Punishments

Q: All right. The hazards we've been talking about so far have mostly involved human or mechanical error. Let's now discuss the hazards arising from deliberate human intent. One of the most serious questions in the nuclear controversy is whether the nuclear industry is creating a potential arsenal for terrorists. How easy would it be for a terrorist, assuming he could get the material, to build a bomb?

A: Assuming he could get the material is assuming quite a bit.

Q: We'll come to that later.

A: All right. Now I personally would not know how to build a nuclear bomb, as I've never been involved in that sort of work. But I have asked many experts in the field, and they all agree that it can be done: that a group of at least three—probably more like six—people, each one with a great deal of experience in a different area, could get together and design and build a bomb. The expertise they would need is in such fields as high explosives, nuclear physics, high-speed computation, electronics, chemistry, mechanical crafts, and radiation protection. It's also a fairly dangerous operation.

Q: One common point is that a lot of the specialized information has already been digested. You can buy things like the *Los Alamos Primer*, full of declassified figures, for $2.06, so you wouldn't have to be as smart as the original scientists were, starting from scratch.

A: Well, I bought the *Los Alamos Primer* and read through it, and I came out with the impression that making a nuclear bomb from reactor-grade plutonium, of the kind you use for nuclear energy, is essentially impossible. So I can't imagine anyone thinking that that would give him a good start on making a bomb. You'd have to go far, far beyond that.

There has been a lot of publicity recently about two college students who apparently did [see Alan L. Miller's review of *Mushroom*, p. 184]. First, there was the MIT stu-

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dent who designed a bomb and became the subject of a *Nova* program on public TV. *Nova* cited a Swedish expert, who thought the design might work. The nationality of the expert, by the way, is important. If you've ever been told a story that some college kid designed a bomb and showed it to some American experts who said that it would work, this story is probably a lie. Nobody who's ever worked on our atomic bomb project is allowed to discuss it or give any information about it, and telling somebody that some particular design would or would not work would be divulging very secret information.

So the MIT student's design was said to have been judged by a Swedish expert. What a Swedish expert is I don't know, because of course Sweden has never made a nuclear bomb. In any case, all the Swedish expert said, according to the producer of the program in a private letter to me, was that this student's design had a "small chance" of working.

The Princeton student, who got even more publicity and who has now written a book, didn't strictly speaking, design anything. He never made a drawing with dimensions, which is the minimum requirement for what can be called a design. I talked to the student's professor, who said he knows of no evidence that the student's concept was workable. So these stories are grossly exaggerated.

I should also point out that fabricating a bomb is many times more difficult, expensive, and time-consuming than designing one.

Q: Let's return to the question of theft. In 1974, John McPhee, in *The Curve of Binding Energy* [see B. Bruce-Briggs' review, p. 182], quoted a former director of Nuclear Materials Safeguards at the old Atomic Energy Commission as saying, "If you want a few grams of plutonium, you can steal that almost any place in the country."

Photo by Jan Lukas

A: That was to some extent true when McPhee's book was written; but it certainly isn't true now. Theodore Taylor, who spearheaded the criticism of plant security and provided much of McPhee's information, told a congressional committee in 1975 that he was encouraged by the recent actions of the Nuclear Regulatory Commission. Plutonium is now very carefully protected. Anywhere it's used in the industry, it's in a secure area which can only be entered by people with special clearance. Coming out of that area, they have to pass through doorway monitors, which are capable of detecting very small amounts. When the plutonium is transported, it's in an armored truck—like a Brink's truck—carrying an armed guard, in some cases with a separate vehicle following it, also carrying an armed guard. These vehicles are in constant radio communication with a base, so that if anything happens they can immediately call for help. In all fairness, it should be said that McPhee's book was instrumental in causing the changes to be brought about. But the possibility of stealing enough plutonium to make a bomb is now very remote.

Q: Have similar changes been made in the methods of keeping track of material within plants? Again, McPhee quoted another former director of Nuclear Materials Safeguards: "The AEC can say that quantities of Materials Unaccounted For are not dangerous. This is not so. Tons have been lost."

A: This is true. Until recently, the only method of keeping track of plutonium was weighing it when it entered a plant, weighing it again when it left, and noting the difference between what went out and what came in. Now, anytime you weigh something, there's a certain amount of error. If you assume that you made the maximum error on the low side when the material came in, and the maximum error on the high side when the material went out, this gives you MUF—Materials Unaccounted For—the maximum amount that might be missing. These are rather large quantities if you consider all the material that's gone in and out of plants. Furthermore, in plants that do chemical processing some plutonium sticks to pipes or goes down the drain. In the 1950s and 1960s people were more relaxed about the problem and procedures were less tight than they are now. Considering all this, there is a considerable amount of plutonium that could probably be called missing. On the other hand, there is no evidence that any significant amount of plutonium was ever diverted for illegal uses.

Q: How do they keep track of it now?

A: In the most advanced systems they use very sophisticated techniques. At every stage of the system, the plutonium is monitored by radiation detectors, and the inventory is tallied in a computer. If anything unusual happens to these quantities, the computer gives an immediate warning so immediate action can be taken.

Q: Many critics worry that if our security becomes tight enough, it will be *too* tight. If all our electric power came from nuclear plants, and if the protection we give them now were multiplied accordingly, does that equal a police state?

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"Predictions of nuclear electricity so cheap it would not have to be metered have been shattered by skyrocketing plant costs."
—Ralph Nader

A: The thing that always saves you, whenever nuclear power is concerned, is the very small quantities involved. If all our power came from fast breeder reactors, which are the ones that use the most plutonium, the total amount of plutonium that would be used in a year would fit in a typical home bathroom; and the total amount of plutonium in existence in the whole country, including everything that was in storage and in reactors and being processed, would fit into a living room. Protecting it would scarcely take a security force that resembled a police state.

There's one final point about nuclear terrorism that's often ignored. And that is that a nuclear bomb that could be built by terrorists is not a bomb that could blow up a city. The bombs envisioned by Ted Taylor in McPhee's book are bombs that could blow up a large building. The example he gives is the World Trade Center in New York. Now it's true that if you used such a bomb in the World Trade Center, you could kill everybody in it, and sometimes there are fifty thousand people in that building. That's the source of the statement that one of these bombs could kill fifty thousand people. On the other hand, I think you should realize that there are many much easier ways of killing a lot of people, if that's what you have in mind. For example, you could put poison gas into the ventilation system of the World Trade Center. You could use conventional explosives or incendiaries anywhere large crowds gather—in stadiums, or Christmas shopping. You could blow open a dam; you could poison a reservoir. In fact, there are experts on terrorism who say it would be a good thing if terrorists became preoccupied with nuclear bombs, since it would distract them from more feasible methods of mass murder.

Q: Let's consider terrorists who happen to preside over countries. By encouraging nuclear power, are we making it any easier for other nations to build nuclear arsenals?

A: This is a difficult question, which is more political than scientific. Some of the scientific aspects of it I think have been widely misunderstood. In the first place, none of the six countries that have made nuclear weapons has made them from the type of material that's obtainable from a power reactor. There are two far superior ways of making bombs. One is to build facilities for separating uranium isotopes; the other is to build a plutonium production reactor, or a large research reactor which can be converted for use in plutonium production. All six countries that have made nuclear weapons have done so by one or both of these two methods. These are much cheaper ways of doing it; it costs about one-tenth as much to build these facilities as it does to build a power reactor. It would also be much quicker—these plants could be built and put into operation in two to four years, whereas building a power plant is a five- to ten-year proposition. Finally, the materials which are obtained from research reactors or uranium separation facilities are much easier to make into bombs, and make much better bombs. If you made a bomb using either enriched uranium or plutonium from a plutonium production reactor, it would have an explosive yield ten times higher than a bomb using an equal amount of material from a power reactor.

The only advantage anybody can see in using power-reactor plutonium is that if a nation already had a power reactor, and if it suddenly decided that it wanted a nuclear bomb and wanted it fast, then it could get it faster diverting plutonium from its power reactors than if it had to build another facility from scratch. The bomb still would be more difficult to make and give less explosive power.

Q: Would we notice it if they suddenly started doing this?

A: That would be another safeguard. Power reactors are subject to constant inspection by the International Atomic Energy Agency; and if they did divert plutonium from a power reactor, this would be recognized and political steps could be taken. On the other hand, this would not be true of the other facilities I mentioned. A nation could build a reactor for plutonium production, or a uranium isotope separation facility, without any need to have an International Atomic Energy Agency inspection.

Q: Couldn't reprocessing be banned altogether?

A: That's what the Carter Administration is trying to do. Our current policy is to ask other countries not to reprocess nuclear power reactor fuel, and to set a good example, we have stopped doing it in the United States. Of course, we are continuing to reprocess fuel for weapons, which to some extent contaminates this high moral position. Moreover, at least 14 other countries already have reprocessing facilities and none of them has been shut down; in fact, Japan recently started up a new plant. Even if we contrived to stop reprocessing all over the world, a country that decided it wanted a nuclear weapon could easily set up a secret reprocessing plant. The reprocessing technology is rather easy and well-known. It is also a relatively small operation that takes something like five to fifteen people.

Q: If it's so easy for a government, why is it hard for terrorists?

A: Terrorists would have to get the spent fuel in the first place, which would be no easy thing. A government has control of its own nuclear fuel, so it would have no problem there. Reprocessing also takes a few scientists, a year or two of time, and a few million dollars—so it is probably too big an operation for independent terrorists, but it would be easy for a government.

The other problem with the Carter policy is that there are many countries in this world that desperately need a breeder reactor system. I said that the United States probably has enough uranium to take us through the rest of this

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century, but this is not true of other countries. Japan and Western Europe are very short of energy sources. They also have little or no uranium—the only way they have of getting any measure of energy independence is through a breeder reactor program. So it would be very difficult to get these countries to stop their breeder reactor programs, or even to stop reprocessing. And in fact, they are going ahead.

The common bogeyman in proliferation arguments is Uganda. What if Idi Amin got a nuclear bomb? Wouldn't he do all sorts of terrible things with it? In the first place, a small, undeveloped country like Uganda could not afford and most likely could not use a power reactor. You also have to ask, How much damage could a country like Uganda do? It doesn't seem likely that it would be able to start a world war. I think it's much easier to imagine a worldwide nuclear conflict being started by two much more powerful nations fighting over Middle Eastern oil. So by helping solve the energy problem, the nuclear program, I believe, makes a powerful contribution to avoiding the causes of great wars.

Insufficient Alternatives

Q: Why is nuclear power needed to solve the energy problem?

A: Chiefly because the other sources can't do the job alone. For Western Europe and Japan, it is the *only* avenue to some measure of energy independence. As for us, we're running short of oil and gas. The price is going very high, and we're paying a price in terms of international political pressures to get oil. Everyone now realizes that it's almost a crime to use oil and gas to generate large-scale electric power. At present, 30 per cent of our electricity is generated by oil and gas; so one immediate need is to replace that 30 per cent. Another need is to accommodate growth in our economy, which is closely coupled to growth in the use of electricity.

Q: Why is it "a crime" to use oil and gas for generating electricity?

A: It's much cheaper to substitute coal power or nuclear power; and we need oil and gas for other things. Gas is in short supply, it's very valuable for heating homes, and it has many industrial uses. Oil is needed for transportation. Oil and gas, and coal for that matter, are also very useful as feedstocks for producing plastics, organic chemicals, and medicines: and they will become more and more useful in the future as other available materials begin to run out.

Q: If we continue to use oil and gas as we're using them now, how long will they last?

A: These numbers, of course, are very debatable. If we used nothing but our own oil, and our own gas, we might run out in ten or fifteen years. Of course, we're not doing that. We're importing a lot of oil; we're starting to import gas; and we presumably could go to the end of the century before the Middle East starts running short of oil. Of course, how we're going to pay for all that oil is another question.

Q: What about coal? We have a lot of it in the United States; what is wrong with eliminating oil and gas and shifting to coal for all our electric power?

"Plant costs have increased because of the obstructionist tactics of people such as Mr. Nader."
—American Society of Mechanical Engineers, Committee on Nuclear Power

A: That's a reasonable thing to do, and I would say if we didn't have nuclear energy available, we should do that. On the other hand, when you compare coal and nuclear, one against the other, nuclear will be cheaper, according to at least 90 per cent of the economic studies; it has certainly been cheaper up to now. It's also environmentally far, far superior. The estimates of how much less harmful to health nuclear power is than coal vary from factors of a thousand or more, according to government estimates, down to factors of ten, according to the estimates given by the severest nuclear critics.

Finally, coal has other important uses. It can be used to make synthetic oil and to make plastics, organic chemicals, and medicines; whereas the uranium that's used for nuclear energy has no other value.

Q: Of course, these are not the only conceivable options. Nuclear fusion is another method of producing power—forcing light nuclei together, instead of splitting heavy ones apart. When do we expect to be able to use it?

A: I don't think anybody expects to be using fusion in any large measure during this century. It may be available for large-scale use early in the next century, say 2010 or 2020. Pessimists say that it may never be practical. [See also, "Fusion—The Future," by Arthur Gray Jr., George Miley, & George Brumlik, p. 162.]

There are three barriers still to be surmounted. The first is scientific feasibility—which simply means that somewhere, in some experimental apparatus, for some short time, someone gets out more energy than he puts in. This has not yet happened, though there's hope that it will in the next few years. The second barrier is technical feasibility—converting an expensive piece of experimental apparatus, made to work for a few seconds by scientists under laboratory conditions, into a large-scale engineering project operated for many years by ordinary technicians. Among other things this will require development of new materials with radiation resistance far superior to anything now available. The last barrier is economic feasibility—when one of these plants is built and operating, and all the problems have been recognized and taken care of, will it be economically competitive with other sources of energy? We don't have the answer to that.

Q: A team of researchers at Princeton recently heated a

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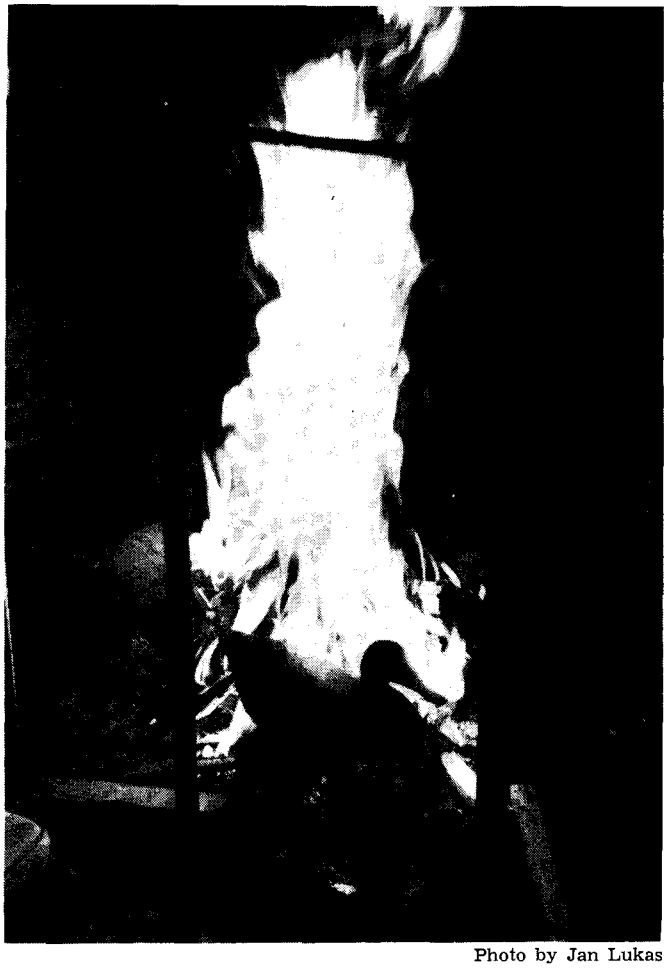

Photo by Jan Lukas

hydrogen gas mixture up to 60 million degrees centigrade using fusion.

A: That was a rather high temperature, and an important accomplishment; but there is still a very long way to go. The problem of demonstrating the scientific feasibility of fusion is to keep a high density of material at a high temperature for a relatively long period of time, all simultaneously. And this has never been done nearly to the point where they have got as much energy out as they put in.

Q: When can we start using solar energy?

A: We're using it now; that's why our houses are warm on sunny days. I think there's a reasonable hope that we can do a lot more home heating by solar energy, and also heating of water. I'd say it's very uncertain whether we'll ever use solar energy on any large scale for electric power generation. It seems almost impossible that it could ever be economically competitive with coal or nuclear energy.

Q: If we heated all our homes by solar power, what percentages would that knock off our electric-power needs?

A: There's very little electric power being used to heat homes these days; so solar heating is principally a method of saving gas and oil.

Perhaps I should say here that the environmental impact of solar energy has not been understood by the public. Large-scale solar collectors require very large quantities of material—steel, aluminum, and so on; and in order to produce the materials for one solar plant, you would have to burn about 5 per cent of the amount of coal you would need to get the same amount of energy from a coal-burning plant over its entire lifetime. Furthermore, burning coal to make steel is more polluting than burning coal to make power, so solar power is only ten times less dangerous to health than power from coal—which still makes it many times more dangerous than nuclear power.

Q: Does that take into account the coal-burning that goes into the making of a nuclear plant?

A: That's trivial by comparison; a solar plant would be ten thousand times larger than a nuclear plant producing the same amount of power. In this I include the entire nuclear plant; the reactor itself, which is the thing that produces the energy, would fit in a large room, whereas a solar plant producing the same amount of energy would have to cover several square miles.

Q: What about some of the more exotic alternatives—geothermal power, ocean thermal gradients?

A: As the name suggests, geothermal power taps the heat of the earth, and this is being done on a small scale in various places, especially near San Francisco, where they're deriving a reasonable amount of power from geothermal steam. But the resources for doing this are very limited. It's hoped that we can someday use hot rocks, which are more widely distributed, by pumping water down into them and converting the water into steam. But this project is in the very early research stages, and it's too early to speculate on its future potential.

Ocean thermal gradients, on the other hand, aren't so far in the future. There are plans for pilot plants to be operating within the next five to eight years; and it's hoped they can produce an appreciable amount of electricity.

Q: What will they take advantage of?

A: In certain spots in the ocean and the Gulf of Mexico the temperature is considerably warmer on the surface than it is deep down. If you use some fluid that boils at the warmer temperature and condenses at the cooler temperature, you can pump it back and forth. As the fluid reaches the warm area, it turns into a vapor and drives a turbine; as it returns to the cooler area, it condenses and starts all over again. There are many problems that will have to be worked out. The temperature differences not being very large, it's a very inefficient system and requires very large heat exchangers. Another problem is getting the power from the ocean to shore. But this seems closer to economic feasibility than any other type of solar electric power—and certainly closer than geothermal energy from hot rocks.

Q: What about biomass?

A: Biomass is the historic method of getting energy. Up until a hundred years ago, most of the energy in this country came from burning wood, and a simple biomass option would be to go back to wood-burning. Of course we couldn't provide anything near the amount of energy we'd need. We could do better by taking advantage of the tropics. We could cover large areas of the tropics with plants that absorb a large amount of energy from the sun, then bring them here and either burn them directly or convert them into alcohol. Alcohol would be especially valuable, since we could use it to drive our automobiles. This is a process which has some promise. It will take a lot of doing, and probably it will never satisfy a major fraction of our needs; but it could make an important contribution.

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Q: Let's consider our needs for a moment. It is sometimes said that the utility system itself is wasteful: that we build unnecessarily complex central generators, which then have to push their power out to individual users—a process that's been compared to cutting butter with a chain saw.

A: There was a time when we all used butter knives—when every factory had its own power-generating station. They soon found it was much more economical to have one big central generating plant and have them all plug into it.

The question of small versus large, or what's sometimes called soft technology versus hard technology, is partly a philosophical one. The primary hope of solar energy enthusiasts is that we can someday put something on our house roof that will give us all the energy we need. That is a beautiful dream; but I see no reasonable technical basis for believing in it.

Q: Would it be any more reasonable if we needed less energy?

A: There's a lot of disagreement about how much our energy use should grow, or whether it will. The growth of our energy use has slowed down; but the growth of our use of electricity has not. Electricity use has been growing by about 7 per cent a year since the beginning of this century, which means that it has been doubling every ten years. This rate slowed down in 1974-75, but in the last three years, it's gone back to the old level. We can't predict growth rates with certainty; but it seems likely that growth will continue.

Q: A final category of questions. How has all the controversy affected the nuclear industry?

A: It's jacked up costs tremendously. When you start to build a plant, and the rules are changed on you as you're building, this runs the cost up a great deal, as anybody who has tried to build a house knows well. Nuclear power plants used to be built in five years. In fact, there's a large plant operating near Rochester, New York which took five years from the time it was conceived to the time it was operating. Its actual construction time was less than three and a half years. Now it takes 12 years to build a plant, from conception to completion. The cost of these delays approaches $2 million a week. A recent study reported that speeding up construction by three years could save as much as $350 million on the final bill. As things stand now, over half the cost of a nuclear plant is in the form of cost escalation and the interest on money during construction.

Q: What happens if these trends continue?

A: I would say the industry is near the point of collapse. Up to 1973, they got lots of orders which they're still working on. But they've had very few new orders for plants since 1973. As I see it, the critical time will be about 1981. If there's not a substantial influx of new orders by then, there will be massive layoffs in the nuclear industry, and all the experts in various aspects of nuclear systems will find work in other areas. And once that happens, it would take a very long time to reassemble them.

Q: And if, by 1981, there has been no influx of orders, then we fall back on . . .

A: Oil. It's the easy way out of all problems—except payment, of course. (We spent over $6 billion on imported oil for electric power in 1978.) Any time we can't build a nuclear plant, or a coal plant, we import more oil.

Now of course there may be expansion in coal production. But the environmental problems are enormous, and with all the pressure to increase the use of coal, the total use has expanded by only about 15 per cent over the last five years.

Q: Could we, as late as 1981, retrieve the nuclear option?

A: Of course, the industry won't have vanished completely. There will be 150 or more power plants in operation, and there still will be enough of a crew to handle maintenance, repair work, replacement parts, things of that sort. But if we ever want to go back and build a lot of new plants after that, the process of gearing up would be long, painstaking, and expensive.

NR: Thank you, Professor Cohen. □

Song for a Biodegradable Jump Rope

Eco Freak, pollution and waste;
Recycle that garbage and serve to taste.

Don't say goodbye to sludge and slime,
Just say farewell till suppertime.

Cesspools, dumps, and septic tanks
All deserve a vote of thanks.

Eco Freako, crud and slush,
For the starving Belgians, flush.

What we think is flushed away
Will be tomorrow's prime filet.

Pass the questions troubling some:
Do scums make man, or man make scum?

Can we make dollars and not make sense?
Can we afford our effluence?

No more phosphates, glass, or tins,
Paper, autos, leopard skins.

War, sin, crime are not the issue—
Stamp out colored toilet tissue.

Pesticides, aluminum,
Come you green crusaders, come.

Eco Freako, sun and sky,
Kiss the modern world goodbye.

When the grass comes out to play
The Eco State will wither away.

Timothy J. Wheeler

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The oil we use for electricity costs $6 billion a year; solar satellites are still in the research phase; dams defer to fish. That leaves coal (cheap) and nuclear power (cheaper)

The Price of Power

MILTON R. COPULOS

TO THE SMALL group of expatriate scientists monitoring their instruments on a grey December afternoon in 1942, it must have seemed that the applications of nuclear power were limited only by the scope of man's imagination. They had achieved the world's first controlled chain reaction, heralding the birth of the nuclear age. The enthusiasm of those early days gave rise to visions of atom-powered aircraft and electricity too cheap to meter. In the course of time, many of these ideas were discarded as flights of fancy; but one concept endured: the production of inexpensive, clean electricity.

Growing Appetite

In 1960, the total installed nuclear capacity of the United States came to only 297 megawatts. (A megawatt is one thousand kilowatts, or one million watts.) By 1977, installed nuclear capacity had increased to nearly 47,000 megawatts, and it currently stands at 52,000 megawatts. Last year, nuclear plants accounted for more than 12 per cent of all the electricity produced in the United States, the equivalent of more than 450 million barrels of oil. Had we imported that oil, $6 billion would have been added to our balance of payments deficit, and consumers would have paid between $2 and $3 billion more for their electricity.

Meanwhile, our nation's appetite for electricity has been growing rapidly. In 1935, electricity accounted for only 5 per cent of all energy consumed in the United States; by 1975 that figure had risen to 36 per cent. If one assumes that demand will continue to increase even moderately, by the end of this century electricity should account for at least one-half of all energy consumed in the United States. In order to satisfy this increasing demand, our nation's utilities will have to add substantial amounts of new capacity in the coming decades. In order to do so, they must build either coal-fired or nuclear plants.

When considering expansion, utilities must take a wide variety of factors into account. Chief among these is the pattern of demand, or load. The level of demand for electricity varies widely between different times of the day and different seasons of the year. Often these shifts in the level of demand are substantial: fluctuations of between 30 and 50 per cent are not unusual. As a result, several different types of generating equipment are required: peak-load units, which are used only during the highest periods of demand; cycling units, used during periods of intermediate demand; and base-load units, used at all times. Nuclear units are used only for base-load generation.

The basic requirements for base-load generators are fairly obvious. The unit must be technologically feasible, and it must meet environmental requirements. It must be economically competitive and have reasonable assurance of access to fuel. What is not so obvious is that, today, there are only two forms of base-load generation that meet these requirements in most regions of the country: coal, and nuclear.

The most frequently cited alternative to nuclear power is solar energy. But while there are some effective applications of this technology already, it is still in its infancy. At present its main applications are to heat water and to supplement home heating. There is also a proposal to construct a solar satellite which would generate large amounts of power, but this has not advanced even to the research and development stage. To date, no technology for the storage of large amounts of solar power has been developed. Until such a technology emerges, solar power will remain primarily a heating supplement.

Geothermal energy has very real utility, but is limited in terms of both ultimate potential and availability. For the most part, our geothermal generating stations would be located in the Western states and would meet with considerable opposition from environmental groups (the greatest number of potentially exploitable geothermal sites lie on federal parkland).

Inedible Perch

During the early days of power generation, hydroelectric stations provided the bulk of the electricity produced in many regions of the nation. Today, however, most of the economically feasible sites have been developed, and the licensing process for projected new sites is even more cumbersome for hydroelectric facilities than it is for nuclear installations the most familiar example being the projected Tellico Dam (undertaken by the Tennessee Valley Authority), which was ultimately halted because of statutory concern over the snail darter, a two-and-a-half-inch-long species of inedible perch, whose

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extinction, under the law, was de ivatively unacceptable.

Recently, interest has been show n in the possibilities of what the Depart ent of Energy calls "low-head hydro." This term simply refers to very small hydroelectric units. Yet even if this o tion were fully developed (and there ave been problems with siting), it is unlikely that such facilities could produce sufficient electricity to meet the exp cted increase in demand. Further, like all hydroelectric facilities, such units would always be at the mercy of the elements, and could go out of service during periods of drought.

Bus-Bar Costs

Finally, there remain oil and natural gas. While there is a temporary glut of gas on the market and there have been recent strikes of oil in Mexico and the North Sea, the continued availability of these fuels is not at all assured. Even if they do remain technically available, their price whether as a functio of strategic scarcity or oligopolistic l verage is likely to make them decreasingly attractive. While oil accounted for 30 per cent of the world's electrical generation in 1976, by 1990 it is expected to account for only 7 per cent, because of rising prices. Whether these predictions come true, however, will depend largely on the development of alternative to oil and natural gas.

The remaining two alternatives for base-load capacity are coal and nuclear. Both are technologically feasible. They meet environmental requirements, and they have reasonably assured fuel supplies. They are also the most economical of the currently available alternatives.

Now, in comparing the economic performance of options available for base-load capacity, we need a frame of reference. The most frequently used terms of comparison are "bus bar" costs. These are the costs incurred up to the point of the transfer of power to the transmission system at a generating-station switch known as the bus bar. They include all costs directly attributable to the particular facility, but exclude those associated solely with the delivery of the power. Bus-bar cost fall into three categories: 1) fuel cost 2) operation and maintenance costs 3) carrying charges, which include depreciation, waste disposal, eventual decommissioning, insurance, property taxes, income taxes, and return on investment.

According to a report by the House Committee on Government Operations, in 1976 the bus-bar costs of electricity produced by coal plants without emission control equipment averaged 15.9 mills kwh. (One mill, to be sure, is only 1 1000th of a dollar; but when multiplied by billions of kilowatt hours, a fraction of a mill changes rapidly into a multi-million-dollar figure.) The cost per kwh of nuclear plants, on the other hand, was 15.49 mills, including allowances for waste disposal and decommissioning, the so-called back end of the fuel cycle. Coal-fired plants *with* emission controls—which become mandatory on all plants as of this year—averaged bus-bar costs of 21 mills kwh. The costs of oil-fired electricity ranged from a high of 30.9 mills kwh in the Northeast (or roughly twice the cost of nuclear-generated power) to 26.6 mills kwh in California. Natural gas cost an average of 26.6 mills kwh in most regions.

Local studies underscore the national pattern. Rossin and Rieck analyzed, in the August 1978 issue of *Science* magazine, the performance of the six large coal and six large nuclear units operated by Commonwealth Edison Company. Their analysis, based on the actual operating experience of the units, demonstrated a clear economic edge for nuclear power. They determined that the system-wide cost for the company's nuclear units averaged 13.3 mills kwh, while the cost at the bus-bar for the six largest units was 13.1 mills kwh. The cost at the bus-bar for all coal-fired units, on the other hand, was 24.1 mills/kwh, while the average cost at the bus-bar for the six largest coal units was 20.9 mills/kwh. Even these figures were slightly biased in favor of the coal-fired

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units, however, since the requirement to burn low-sulphur coal contained in amendments to the Clean Air Act had not yet taken effect. When it does, later this year, the fuel for coal-fired plants will go up by 3.9 mills/kwh.

Government Subsidies

What does all of this mean for the customer? In Commonwealth Edison's case, there were savings of between $200 and $300 million on bus-bar costs—which works out to a 10 to 15 per cent reduction on their customers' electric bills. And Commonwealth Edison is not alone. The cost of nuclear power generated by the Public Service of New Hampshire runs roughly 13 mills/kwh at the bus-bar, while fossil-fueled plants have bus-bar costs of around 22 mills kwh. This translates into a savings of 19.2 per cent to the customer for every kilowatt hour he purchases from nuclear facilities. The ratepayers of the Public Service Company of New Hampshire have not been able to realize the full benefits of planned nuclear facilities, since political and legal harassing action has delayed the availability of the Seabrook nuclear plant, which is designed to furnish 72.75 per cent of their power. Each year that these ratepayers are denied the services of Seabrook, they pay nearly $60 million extra for their electricity.

These differentials exist notwithstanding that the capital costs of nuclear plants are relatively greater: they make up this disadvantage in fuel costs. According to a report issued by the House Committee on Government Operations, the basic cost of nuclear fuel in 1976 averaged 2.7 mills per kilowatt hour. This compares with between 7.7 and 11.5 mills/kwh for coal, and as much as 48 mills/kwh for some types of oil-fired generators. These differences are important since fuel cost is so significant a part of the bus-bar cost of fossil-fueled plants. Once again the operating experience of Commonwealth Edison provides examples. Fuel costs for Commonwealth Edison's nuclear plants accounted for only 26.3 per cent of the overall cost of those plants. On the other hand, the average fuel costs of Commonwealth's coal-fired units accounted for 50.2 per cent of *their* overall costs.

An argument is sometimes made that the low cost of nuclear power is owing to large government subsidies. Critics claim that the cost simply of decommissioning and waste disposal would make nuclear plants uneconomic, and that various subsidies give them an unfair competitive advantage. The facts confute this assertion.

The ultimate cost of nuclear waste disposal concededly varies depending on whether the government decides to allow the reprocessing of spent fuel rods (plutonium and U-235 extracted from such rods could be sold back to utilities for reactor fuel, thus defraying the cost). Pending that decision, estimates of the cost of waste disposal range from 0.28 mills/kwh to 1.37 mills/kwh, according to the House Committee on Government Operations. This approximates the 0.5 mill/kwh charge that many utilities now include on their books as a provision for the disposal of waste. Whatever the ultimate cost is, though, the utilities will not get a government subsidy to cover it. They will be required to pay for waste disposal, and at the rate set by the Federal Government. The same will be true of decommissioning.

The decommissioning issue is relatively new; it refers to the problem of disposing of a nuclear facility once it has outlived its usefulness. Although the problem is real, there are any number of plausible solutions, no one of which would affect nuclear power's competitive advantage. The three major options are: entombment, mothballing, and dismantling.

Enrichment Monopoly

Entombment is defined by the Department of Energy as shipping all fuel, radioactive fluids, and wastes to an off-site storage facility, and interring the generating station in concrete. Mothballing is the removal of the same components, followed by the sealing of all remaining highly radioactive components. Dismantling requires the removal from the site of all fuel assemblies, radioactive fluids and wastes, and any other materials which are more radioactive than the allowable levels then in force. The costs of these procedures range from $2.3 million for mothballing a pressurized-water reactor, to $31.2 million for dismantling a boiling-water reactor. The estimated cost of decommissioning, according to the Department of Energy, could range anywhere from 0.32 mills/kwh to 0.69 mills/kwh depending on which option is selected. As in the case of waste disposal, none of the options currently under consideration would significantly change the current cost relationships between nuclear power and the other options for generating electricity.

Another subsidy the critics claim is given the nuclear power industry is the cost of fuel enrichment. This is so far from true that it verges on the ludicrous. The fact is that the government, which maintains a monopoly on fuel enrichment for national security purposes, *charges* its customers—the nuclear utilities—for its services; and even manages to show a profit. Net income from enrichment services in Fiscal Year 1976 alone came to $110 million, representing a 13 per cent return on the government's basic investment in enrichment facilities. In addition, the commercial enrichment operation allows the government to recoup an annual $50 million in depreciation on the facilities. Since the enrichment facilities were constructed for the weapons program, they would have been built with or without the advent of commercial nuclear power. Without the peaceful use of the atom, though, there would have been no way to recoup the investment.

Critics frequently cite a figure of $9 billion, supposedly spent by the government for nuclear research and development. In fact, only $3 billion can properly be claimed to have been spent on commercial nuclear power, in the development of the light-water reactor and the various technologies related to it.

Regardless of the amount, the investment has proven to be more than worth while. There are currently 72 reactors operating around the nation, and they represent an investment of some $20 billion of private capital. Commitments on reactors currently under construction come to another $75 billion. In addition to this $95-billion capital investment, the 72 operating reactors produce energy equivalent to $6 billion worth of oil. In so doing, they substantially reduce our balance of payments and, since they produce this energy more economically than oil, create substantial savings for consumers.

Of all the alleged subsidies to nuclear

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power, perhaps the most misunderstood is the Price-Anderson Act. [See p. 146.] Critics are quick to raise the specter of billion-dollar accidents which, they assert, the Act will not cover. They argue that only with unlimited-liability will the interest of the public truly be served. The problem is that there is no such thing as unlimited liability insurance. A company can only underwrite policies within the limits of its assets and premiums, and with reference to its actuarial data. Further, there are numerous precedents for limitation on liability. The back of every airplane ticket carries a notice to passengers of limits on the airline's liability. Shipping companies have similar limits, and even the Federal Government frequently limits its own liability—most recently in the swine-flu program. Beyond these simple facts is the additional consideration that there is no real rationale for unlimited-liability insurance in the history of the nuclear industry.

Safety Record

Under Price-Anderson as currently constituted, there are three types of insurance. The first level is covered by a private insurance pool; the second by contributions the individual utilities pay to the Federal Government; the final level is a guarantee by the Federal Government. The first two tiers cover the first 80 per cent of the mandated amount, and as more reactors are built, utility contributions will eventually cover the entire amount. What is significant, though, is that in the 21 years the pool has been in operation, the Federal Government has never had to pay a claim. In fact there have been only thirty accidents which could lead to the eventual payment of claims, and the total expenditure to date for all losses and loss-related expenses has been only $600,000. No other industry has so admirable a safety record.

After exhausting their arguments about waste disposal, decommissioning, and subsidies, critics eventually settle on the charge that large nuclear facilities are simply unreliable. To support their claims, they frequently cite *Power Plant Performance* by Charles Komanoff. This study has been the subject of considerable scrutiny of late, both for its conclusions and for its obvious inaccuracies. In the hearings involving the Marble Hill Public Service Company of Indiana, the Nuclear Regulatory Commission "reject[ed] the above specific predictions of Mr. Komanoff because the record shows they are not precise and therefore misleading . . . In addition, Mr. Komanoff's analysis must be rejected because of numerous serious errors in his methodology. . . ."

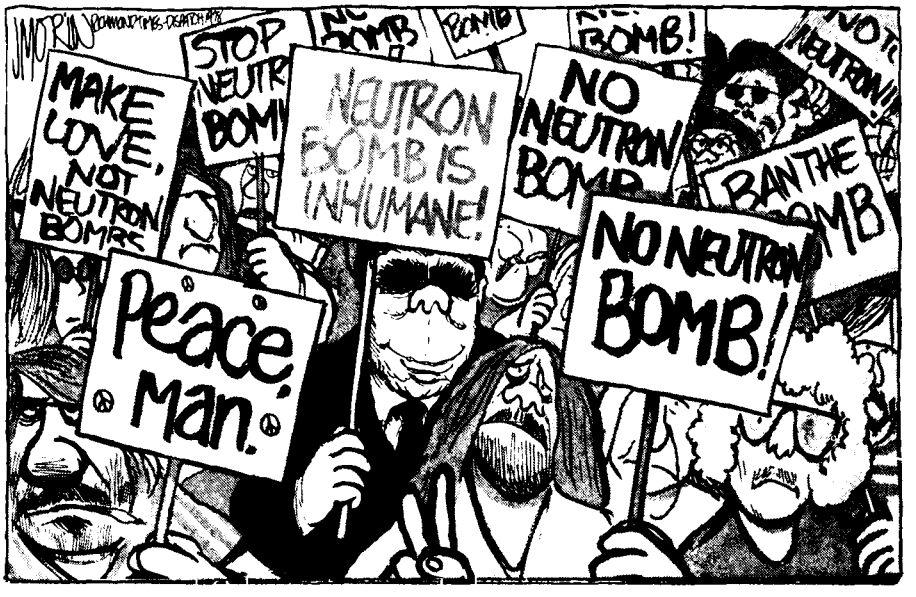
Cosmic Folly

When accurate data are examined, the reliability of nuclear power plant facilities compares favorably with that of alternative sources. The reliability of a power plant is represented by its "capacity factor"—the amount of power it actually generated, as compared to the amount it *could* have generated if it had run 24 hours a day, full out. In 1976, according to the Department of Energy, the net capacity factor for nuclear power plants was 59.7 per cent; for coal-fired plants, 56.4 per cent; and for oil and gas plants, 50.7 per cent. In some regions, such as New England, the capacity factors of nuclear plants ranged as high as 85 per cent. These figures are obviously a long way from indicating any unreliability on the part of nuclear power.

Even including high capital costs, nuclear power compares favorably with some of the more esoteric alternatives. For example, the proposed solar thermal electric plant to be built in the Mojave Desert as a demonstration facility is slated to cost $100 million. Even ignoring Cheops' Law, which states that nothing is ever built on time or within budget, this still represents a capital cost roughly ten times that of nuclear plants. The cost of solar photovoltaic cells runs two to three times as much, or twenty to thirty times the cost of a nuclear plant. This is not to say that solar energy should not be developed it should. It offers great promise. Until that promise is realized, however, it cannot replace nuclear power. The same is true of the other suggested alternative technologies. Wind generators cost five times as much as nuclear plants on a kilowatt basis and have a maximum reliability rate of 30 per cent, or roughly half that of nuclear.

There is, of course, coal, and in some parts of the country coal has enjoyed a considerable cost advantage. With the advent of pollution control requirements, however, this advantage has been somewhat diminished, making nuclear more attractive in regions where coal previously dominated. The point, though, is not that coal is uneconomic or should not be developed.

If we are to avoid a repetition of the dilemma created by our former overdependence on fossil fuels, then we must develop all of our energy options to the fullest possible extent. Any rational approach to providing for our future energy needs must include developing both coal and nuclear power, as well as a host of alternative technologies. To do otherwise would be folly of cosmic proportions. □



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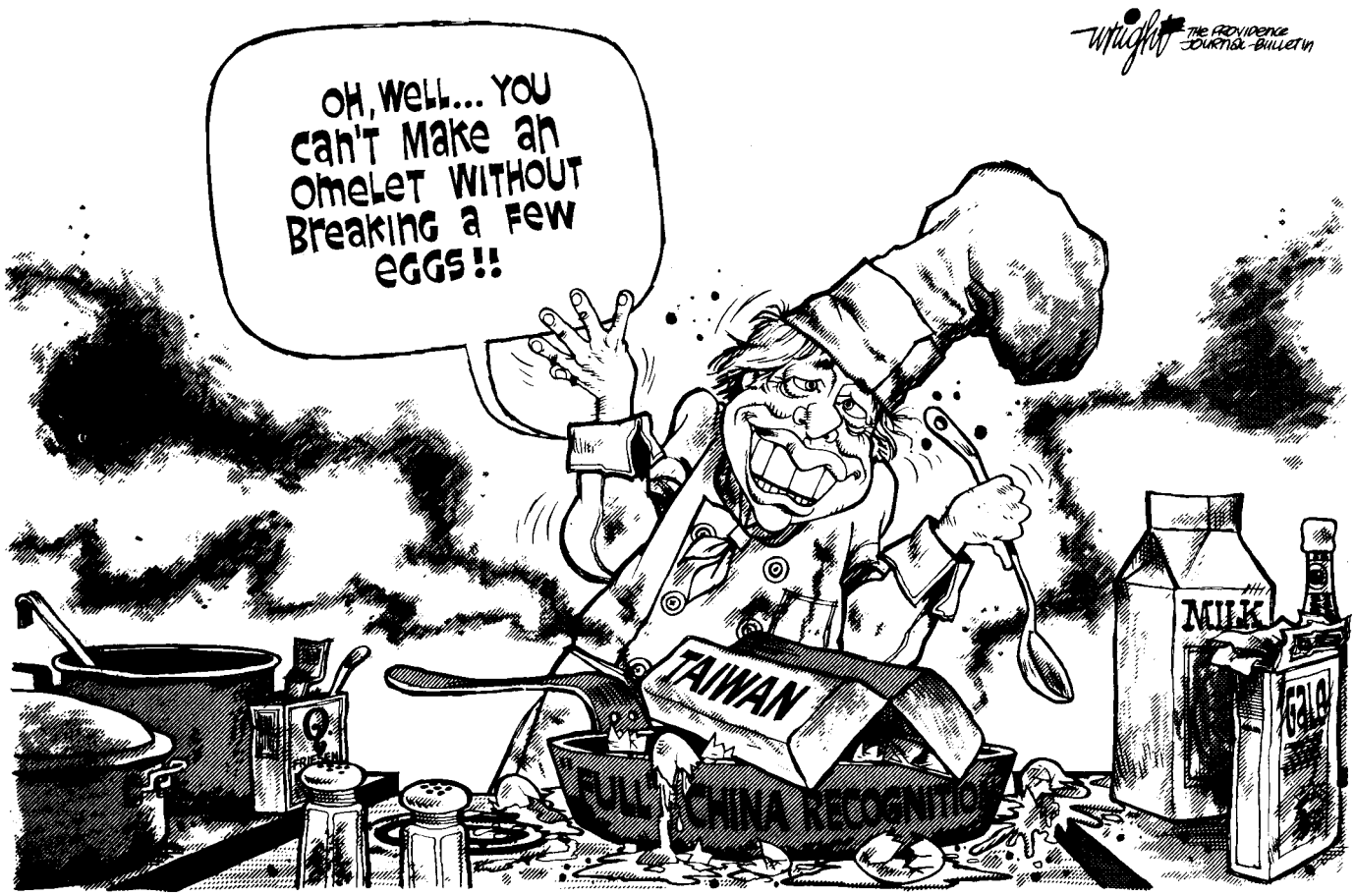
help!!!!

Born Again

The veil is back in Isfahan;
  In Qum, the mosques are full.
In Hamadan, the mullah's call
  Exerts an ancient pull.
The cinemas are burning down
  And liquor's hard to find,
But I doubt this revival is
  What Jimmy has in mind.

W. H. von Dreele

"They made a mistake at the Artificial Insemination Center, Jim. You're the first man in history to be cuckolded by a sperm bank."



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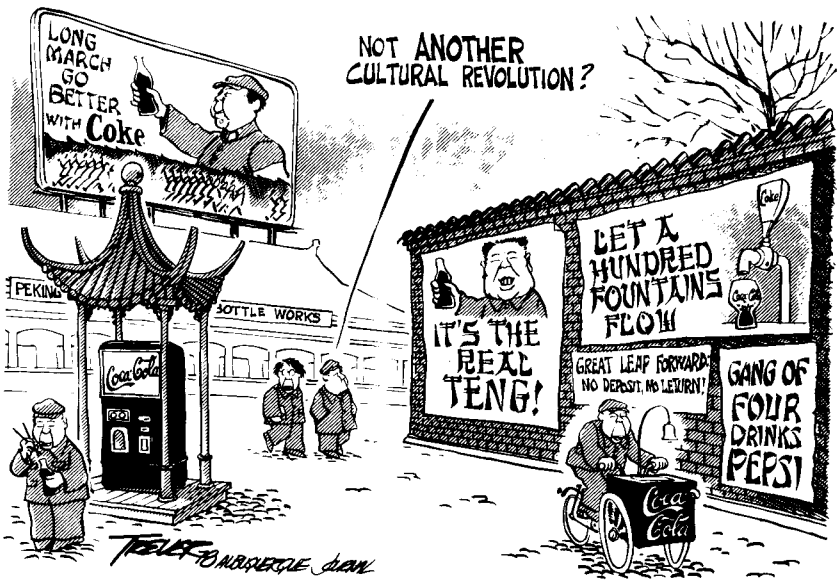

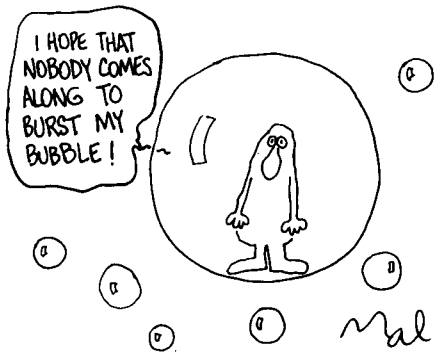

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THE U.S.A.

Fusion—The Future

ARTHUR GRAY JR., GEORGE MILEY & GEORGE BRUMLIK

THE HISTORY of man is a record of progress directly tied to a continuing reduction in the cost of energy. From the discovery of fire and the wheel, to the harnessing of coal, oil, and natural gas for the generation of electricity, man's material lot has improved in direct proportion to the cost and availability of energy.

Now that fossil fuels have reversed their curve of cost efficiency, and other sources of energy (winds, tides, solar energy, fission, geothermal and hydroelectric power) have become economically attractive *only* in comparison to the ever-increasing cost of fossil fuels, we must look to what is the cheapest source of future energy in our universe—fusion.

Having low-cost energy available once again is not a dream, but a reality whose timing depends on us. Nature has stored on the earth's surface vast amounts of energy in the form of nuclei of isotopes of light elements—hydrogen, helium, lithium, boron. These abundant materials can be made to burn in nuclear fusion reactions, wherein they will release a *million* times more energy than a comparable weight of burning coal or oil. The magnitudes involved here are so fantastic that their meaning escapes us. If the price of oil dropped from $15 to $3 a barrel, the stock market would skyrocket; yet the energy provided by a million truckloads of oil can be replaced by the energy contained in a single truckload of fusion fuel.

What then would be the cost? The accessibility and abundance of the raw materials used in fusion fuels—isotopes of hydrogen and the other light elements mentioned above—make their cost essentially negligible. Construction of small, compact power plants could cost a fraction of present-day utility systems, if they could be mass produced with suitable confinements. And by placing them wherever they were needed, we could slash transmission costs. As the price of electric power then fell, electricity could replace oil and gas in heating and suburban transportation—another important saving. Fossil fuels could then be reserved for chemical feedstocks.

The single major expense involved in fusion energy is the enormous research and development outlays still required to bring the technology to fruition.

Cutting Timetables

Research will be needed to explore the questions of which elements represent the best fusion fuels, and what means of confinement are most economical. The cost of this research, however, is a one-time investment, because of the abundance of the fuels; whereas the costs of oil exploration, which are currently far greater than the proposed outlays for the fusion effort, have to be carried on continuously as old wells dry up.

Fusion energy seeks to duplicate on earth a process which takes place in the sun. (When we speak of using "solar energy," we are talking about capturing this energy after it has traveled over ninety million miles to reach earth. That is neither very efficient, nor very cheap.) In fact, we have already duplicated the solar process here on earth. We have burned deuterium and tritium and lithium isotopes; but we had to use a fission reaction involving uranium and plutonium as a match. Result: the hydrogen bomb. Now we must find a safer match and learn how to produce a controlled fusion reaction.

At fusion temperatures, matter forms a gas of free ions and electrons called a "plasma." When such conditions persist, confinement is obviously a key problem. A normal containment vessel cannot be used, since the hot plasma would melt material walls. At present, two sophisticated approaches—*magnetic* confinement and *inertial* confinement—are being pursued.

Magnetic confinement experiments, in most cases, make use of the "Tokomak" concept, originally developed in Russia [see also "Meanwhile, in the Soviet Union . . ." by Wil Lepkowski, p. 168] and now being advanced at various Department of Energy laboratories including the Princeton Plasma Physics Laboratory and the Oak Ridge National Laboratory. The Tokomak employs magnetic fields in a closed configuration shaped like a large doughnut. An alternative approach, called "mirror" confinement, uses magnetic fields to reflect plasma particles that would otherwise escape from the ends of an open cylindrical field; it is being developed at the Lawrence/Livermore laboratories, among other places. Dr. Melvin Gottlieb, director of the Princeton Plasma Physics Laboratory, believes that at least 15 years could be cut from the present timetables for development of magnetic confinement by initiating a full-scale research effort now.

Inertial confinement, the second major technology, involves heating a small fuel pellet with a laser or a charged particle beam so rapidly that the inertia of individual ions keeps the plasma together as fusion occurs. Inertial confinement is being pursued at the Los Alamos Scientific Laboratories and the Sandia National Laboratories in New Mexico, the University of Rochester in New York State, the Lawrence/Livermore laboratories in California, and KMS Fusion Corporation in Ann Arbor, Michigan. Dr. John Emmet, Division Leader of the Laser Fusion team at Livermore, is every bit as optimistic as Dr. Gottlieb.

There are yet other approaches to the harnessing of fusion which would be entitled to adequate funding. The Russians are exploring avenues of their own, some of which may be unknown to us. Meanwhile, fusion research has made remarkable strides in recent years. Experimental devices now being built at Princeton and Livermore are

(Continues on page 189)

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European Reactions

WHATEVER America's troubles with anti-nuclear groups, Europe's troubles are worse. In almost every nation in Western Europe there have been serious demonstrations and political discord over the nuclear issue. Nor are these mere sit-ins, like the Seabrook demonstrations in the United States, organized and carried out by fringe elements. The demonstrations are usually violent, and the anti-atomic political forces wield considerable national influence. In Germany, for instance, even the army has not been able to prevent vandalism and personal injury at atomic plants under construction. In Sweden two years ago, the anti-nuclear-power elements combined with non-socialists to topple the social democratic government. The so-called Green Parties—environmentalist and anti-nuclear—have everywhere (except, notably, Britain, which because of North Sea oil has not invested so dramatically as others in nuclear technology) dealt their hands like shrewd poker players.

What could prove to be a European paradigm occurred recently in Austria, which, although a small country, has led the world in all sorts of evolutions and revolutions—classical music, psychoanalysis, national socialism, and theoretical capitalism, for example. Now, in a national plebiscite, Austria has taken the lead in opposing the peaceful use of atomic energy. The vote was terribly close—50.5 to 49.5 per cent.

The issue was joined over the nuclear reactor at Zwentendorf, near Vienna. Six hundred million dollars had been invested in the project, as had the political reputation of Chancellor Bruno Kreisky, the leader of the Socialist government.

The Austrian vote was indicative of the curious political alignment which the nuclear issue has fostered all across Europe. The Austrian Left (Kreisky's Socialists) supported large-scale nuclear fission projects. But Kreisky's son Peter—himself a radical Socialist—demonstrated, publicly and vocally, against the plant. The conservative opposition, the Volkspartei, wavered between opposed and ambiguous, relishing Kreisky's desperate efforts to mount a pro-nuclear coalition. But the League of Industrialists, usually strongly anti-Socialist, favored the reactor. The Catholic Church was officially neutral, but some of its more sentimental sub-groups (especially young people) opposed nuclear power. Scientists were divided, but the least polemical, usually physicists and engineers, favored the Zwentendorf plant. The liberal Freedom Party was opposed because of the problem of nuclear waste disposal.

MANY CONFUSED voters simply stayed home. Austrian elections average a turnout of more than 80 per cent, so the 64 per cent participation in this referendum was appallingly low for so important an issue. The advantage thus turned to the "committed" voters, especially the fervent anti-atomists, and they prevailed. Significantly, the Viennese—who are predominantly Socialist—favored the nuclear plant by more than 55 per cent, and the village of Zwentendorf itself heartily endorsed it, even though it lies in a seismic zone.

It might have been expected that Kreisky, having lost this important vote, would step down. That did not happen—again, because of the confusion factor. With the various cross-endorsements, the blurring of ideological distinctions, and the lack of any consensus in the scientific community, there was no clear result one way or the other—except that the Zwentendorf project will be halted.

How to understand, out of this chaos, the anti-nuclear groups in Europe? First, they do not easily fall under the familiar rubrics of Left and Right. All across Europe there are environmentalist movements which could be called conservative or conservationist. These are the heirs of the anti-liberal, aristocratic reaction. Much more influential, however, is the environmentalist Left, which is simply anti-technological. Theirs seems to be an almost Rousseauian romanticism—*retournons à la nature*—an attack against a polluting, dehumanizing, alienating capitalism. In the past, it was farmers, large landowners, and the clergy who deplored the modernizing influence of the manufacturers, bankers, and liberal intellectuals; now the anti-bourgeois theme is played principally by the Left.

Admittedly, there are dangers in developing atomic energy—but, then, so are there with any new technology. The crash of a single jetliner may kill three hundred people. Over forty relatives, friends, and acquaintances of mine have been killed in automobile accidents. At least in part, then, the anti-nuclear movement can be understood as expressing dissatisfaction with the risks of modern life. This dissatisfaction, in turn, ties in with the characteristically right-wing *Nostalgiewelle* (the wave of nostalgia) that is currently sweeping Europe—the view that modern times are bad times, that the Golden Ages occurred in the past.

But the anti-nuclear movement *does* have a harder edge. After all, leftist fervor against atomic plants is not aimed across the Iron Curtain, although the USSR is busily constructing nuclear plants, as are others of the East European countries. Assessing the anti-nuclear zealots, one senses the tug of puppet strings from Big Brother in the East. The Communists would savor the industrial weakening of the West, and especially the growing dependence of the West upon the East as a source of energy—supplied, as it will be in the future, by Soviet nuclear power plants. In this respect the anti-atomists are the Soviets' dear allies. Do they realize this? Some do; many do not. One thing is certain: there will be no anti-nuclear movement in the USSR. □

Mr. Kuehnelt-Leddihn, whose next book will be The Intelligent American's Guide to Europe, *has commented on European affairs for* NATIONAL REVIEW *for 23 years.*

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AGITPROP

Not all opposition to the development of nuclear power in the West is homegrown. Once again, the Soviets demonstrate their talent for ideological hitch-hiking

Power and National Sovereignty

BRIAN CROZIER

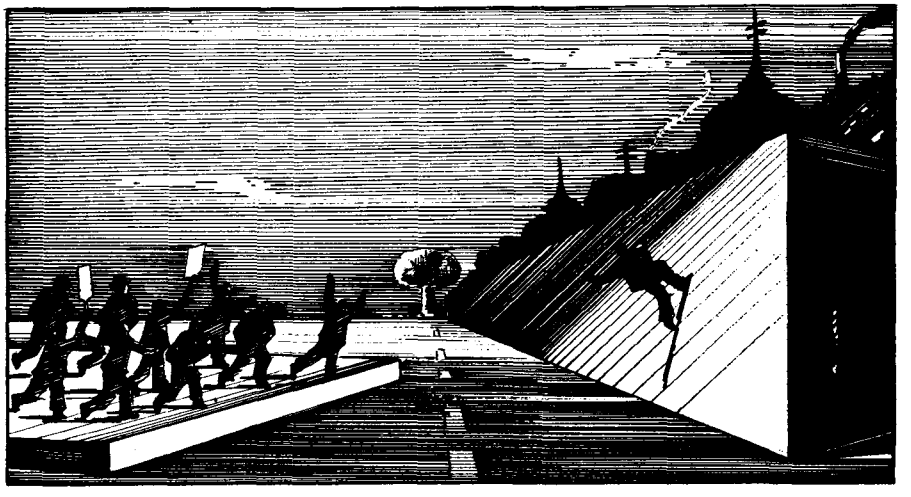
THERE ARE striking similarities between the anti-nuclear movement of today and the anti-Vietnam War movement of a decade ago. In each case deep emotions were generated. Those who protested against American involvement in the Vietnam War were by no means all scoundrels, morons, or Soviet agents. Many were idealists or moralists—some, indeed, were men and women of high intellectual abilities and impeccable motivation. The same is true of the anti-nuclear movement. In both movements one finds the same proliferation of organized groups, many of them tiny and with their own distinctive press (which tends to be of insignificant circulation). In the Seventies as in the Sixties, these groups have tended to coalesce and establish international links. Today, as ten years ago, it is in the clear interest of the Soviet Union to penetrate the respective movements and use them for its own purposes.

If *cui bono?* were the only criterion, then the subversive machine of the Soviet Union would stand instantly convicted of being the motive force behind the anti-nuclear movement. And certainly there *is* clear evidence of Soviet involvement; however, it would be misleading to assert that the sinister Russians started it all or that they have achieved full control of the movement. The picture that emerges is a good deal untidier than that.

Let me dwell for a moment on Soviet motivation. Although the Soviets did not invent "people's revolutionary war," they have enormous experience in the techniques of agitation and propaganda, and of the penetration and manipulation of groups, movements, and parties. They undoubtedly control a gigantic apparatus of subversion through the KGB, the GRU (its military counterpart), the International Department of the ruling Communist Party, and the huge, if ramshackle, network of international or national front organizations. In addition, the world Communist movement, though considerably less monolithic than in Stalin's day, is still on many issues an instrument at Moscow's disposal.

During the long years of the second Indochina War, and particularly from 1965 onward, after Khrushchev's successors decided to give massive aid to North Vietnam, it was in the Soviet Union's interest to destroy America's will to continue the war. As it happened, many Americans were against the war anyway; what the Russians did was to take advantage of the national mood, canalize it in predetermined directions, and coordinate the pressure groups internationally, thus contributing, behind the scenes, to the destruction of the American Establishment's will to continue fighting. (Watergate was another question altogether: the Russians respected Nixon and were doing rather well out of the developing concept of detente; they were bewildered and discomfited by his downfall.)

In regard to the anti-nuclear movement, the Soviet interest is slightly less clear-cut. The undermining and ultimate destruction of the "capitalist system" (i.e., liberal democracy) is a permanent policy aim if only because the Soviet autocracy cannot hope to survive if it abandons the Marxist-Leninist dogma which justifies its existence. On the other hand, during the current phase the Soviet regime is deeply and perhaps increasingly dependent on Western and Japanese technology. This makes the Kremlin rather schizophrenic on the



Mr. Crozier, author of Strategy of Survival, *is the director of the Institute for the Study of Conflict.*

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subject. The anti-nuclear movement certainly weakens the capitalist camp and will prevent the growing gap between Soviet and Western achievements from reaching catastrophic proportions in the immediate future. On specific issues especially military ones such as the enhanced radiation warhead (popularly known as the neutron bomb), the Russians will mobilize their entire propaganda resources without ambiguity. But it does not follow that they wish to destroy the peaceful nuclear capacity of the West or keep Western technology from making any progress in this field.

ANOTHER aspect deserves comment. In Stalin's day, Moscow controlled the entire world Communist movement with minor exceptions here and there: the Trotskyist challenge was insignificant and the wilder varieties of revolutionary activity did not constitute a challenge or a problem. Those good old days are over. Many Communist parties are recalcitrant, including the important ones in France and Italy. There has been a considerable revival of Trotskyism, which, in many countries, has absorbed the frustrated revolutionary fervor of young people who want to believe in Marxism-Leninism but are shocked by the bureaucratic tyranny of the USSR. A permanent aim of Soviet policy in these new conditions is to try, if at all possible, to restore the monolithic unity of the international Communist movement under Soviet control and to penetrate and ultimately direct the activities of Trotskyist and other far-Left groups and parties. Soviet successes in these fields should not be underestimated, although the final goal of unity is a long way off and may never be reached.

Let me now be more specific. The anti-neutron-bomb campaign may seem to be a separate issue. Separate, that is, from the issues raised by the environmentalists, as well as from the central concern of this issue of NATIONAL REVIEW, which addresses itself to nuclear-power development, not to the development of nuclear weapons. But I believe the Soviet campaign against the neutron bomb is worth a digression because it is a perfect example of the successful mobilization of propaganda resources for a single and specific objective.

The United States' development program for the neutron bomb (Enhanced Radiation/Reduced Blast Warhead) triggered an instant Soviet response. As with all weapons since the bow and arrow, the neutron bomb must be considered within the realm of moral relativities. Its purpose was to keep civilian casualties as low as possible and reduce damage to buildings and installations, while stopping Soviet tanks in their tracks. Not having a neutron bomb themselves, the Soviets concentrated on destroying the will of the American leaders to add it to their own arsenal. Hence the neutron bomb was presented as an inhuman weapon, designed to kill people while leaving houses and office blocks intact. It was presented as an intolerable escalation of the arms race.

There was a sinister irony in the fact that while the anti-neutron-bomb campaign was gathering strength, the Soviets were deploying SS-20 intermediate-range ballistic missiles in Europe—each of which carries three independently targeted warheads, each of which, in turn, could devastate a city in Western Europe. Is it more immoral to kill Soviet tank crews than to destroy entire European cities? Not having a public opinion to bother about, the Russians could ignore West European anxieties on this score.

The Soviet campaign against the neutron bomb is worth a digression because it is a perfect example of the successful mobilization of propaganda resources

By the end of 1977, the Soviet campaign was in full swing. On Christmas Eve, Leonid Brezhnev himself gave an interview to *Pravda* in which he proposed that the U.S. and the USSR jointly renounce the production of the neutron bomb. The point was that the United States had the technology and was ready to start, while the Russians had not. Essentially, the Soviet leader was offering to give up something Russia didn't have in return for something the Americans were on the verge of having. Personal messages signed "Leonid Brezhnev" went out to the leaders of all the states involved in the Conference on Security and Cooperation in Europe (CSCE): "If the West developed this fearsome new weapon," he said, "the USSR would not remain a 'passive onlooker.'" Brezhnev himself might be considered the biggest gun in the propaganda armory, but, as usual on such issues, the main machinery in use was that of the World Peace Council—Soviet-controlled and perennially active. Although WPC conferences are, as a rule, packed with Soviet and other Communist delegates, there is normally a sprinkling of well-meaning progressives from Western countries.

In the fall of 1977, the WPC had launched a massive petition appeal for a ban on the neutron bomb. Recipients were urged to write to President Carter about it. In September 1977, the WPC published a booklet entitled *Neutron Bombs: No!* and in January 1978 another booklet followed: *Ban the Neutron Bomb*. The issue dominated the conference on the "Consequences of Disarmament" held in Prague in October 1977. Meetings of "peace" movements from Communist countries were held in the same city between November 20 and 22. The well-tamed Soviet religious leaders were called to a meeting in Zagorsk on January 3, 1978. Purpose? To outlaw the neutron bomb.

London and Washington were the next targets. In London an Assembly for Disarmament and Peace was convened; the Washington event, from January 25 to 27, 1978, was more impressive in that it was the first major meeting the WPC had held in the United States, and there were delegates from more than twenty U.S. organizations and from about forty countries. An international "dialogue" on detente and disarmament was organized, and various documents demanding—you've guessed it—a ban on the neutron bomb were circulated. "Campaigns to collect signatures against the neutron bomb," said one statement, "are the largest-scale mass-movement ever launched

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with a view to enlisting public opinion in support of a ban on a certain type of weapon of mass destruction."

Early in February, the WPC sponsored a Latin American peace conference in Mexico City; not unexpectedly, it condemned U.S. imperialism and the neutron bomb. A few days later a Mediterranean conference was convened in Athens; it demanded a ban on the neutron bomb. Toward the end of February the venue was Geneva, where a meeting organized by the WPC and the Swiss peace movement produced a final statement condemning the proposed manufacture of the neutron bomb and calling for signatures opposing it. The WPC president, Romesh Chandra, surprised nobody by supporting Brezhnev's further proposals for neutral renunciation of the neutron bomb. Since so many of the right people were at hand there in Geneva, a conference of non-governmental organizations followed immediately. Once again Romesh Chandra was much to the fore, and the conference issued a statement condemning the neutron bomb.

Next in line was Amsterdam, where an international rally against the neutron bomb was held on March 18. The organizers described themselves as the Initiative Group of the Dutch Movement against Nuclear Weapons. Ostensibly this was a non-Party group, but a leading Dutch Communist was its Secretary.

Naturally, the United States and Western Europe were the principal targets of the campaign. Not for the first time, the fact that the United Nations is based in Manhattan proved useful to the Soviet propaganda machine, which proceeded to organize an anti-neutron-bomb rally both at UN headquarters and in its subsidiary organizations. When President Assad of Syria visited Moscow in February 1978, he was persuaded to join in condemning the bomb and its deployment. Libyan and Algerian leaders who visited the Soviet capital at about the same time wouldn't go that far; they merely joined in a more general appeal for disarmament. A Communist delegation from Iraq in January was, understandably, more cooperative.

When the UN's Special Assembly on Disarmament was convened in May, Communist speakers could claim fairly convincingly that "international" public opinion supported the righteous Soviet stand against developing the Enhanced Radiation Warhead.

The outcome of this truly impressive campaign is well known: it was undoubtedly a major success. On April 7, 1978, President Carter announced that production of the neutron bomb would be delayed. The ultimate decision, he said, would be influenced by the degree of restraint the Soviet Union showed in its own conventional and nuclear arms program. He also referred to the need for restraint in the deployment of weapons affecting the security of Western Europe and the United States. This patent success was insufficient for Mr. Brezhnev, who on April 25 described Jimmy Carter's decision as a "half measure." He added that the Soviet Union would not itself begin to produce the neutron bomb so long as the U.S.A. exercised similar restraint.

Andrei Sakharov has given warning 'that there exists a political interest on the part of the Soviet Union in exploiting energy shortages in the West'

How have the Russians applied these same propaganda resources to the campaign against nuclear power? The clearest evidence of Soviet involvement in the environmentalist movement lies in the known sponsorship of the Philadelphia-based Mobilization for Survival (MFS). Among these sponsors are the U.S. Peace Council and the American Friends Service Committee—both of which are affiliated with the major Soviet-backed international front mentioned above, the World Peace Council. It is more interesting still that another sponsor of the MFS is the Washington-based Institute for Policy Studies (IPS), for the list of IPS trustees includes a name much in the news in furthering the objectives of the KGB and destroying the CIA: Philip Agee.

Is Agee an agent of Soviet intelligence? The circumstantial evidence alone is so strong as to leave little doubt on this score. A former CIA official, whose experience had largely been gained in Latin America, Agee, upon defecting, went to Cuba and worked closely with the Cuban clandestine service, known as the DGI—itself a wholly controlled subsidiary of the KGB. Moreover, he was deported from Britain because of his contact with Soviet bloc intelligence services, which were held to threaten British security. His main line of work, of which he has frequently boasted, is to publish the names of real or alleged CIA agents abroad (one consequence of which was that the CIA man in Athens was murdered). Agee went to Moscow during the year before his deportation from Britain, and one suspects it was not to discuss the achievements of Soviet gymnasts or weightlifters.

The IPS has been described as the link between the respectable and the revolutionary Left. That is one way of putting it. The other way would be to say that it is the perfect intellectual front for Soviet activities which would be resisted if they were to originate openly from the KGB. The IPS has a subsidiary in Amsterdam, named the Transnational Institute, which has been much involved in this winter's efforts to discredit the Shah of Iran in Western countries. The point that interests us, though, is that the Transnational Institute recently linked up with the new World Information Service on Energy (WISE). The aim of this group is to "develop information on the transnational character of the nuclear industry." In its bi-monthly journal, WISE advocates taking "direct action" against nuclear power. At a conference held in Geneva some months ago, the MFS launched the so-called "International Mobilization for Survival." The MFS had sponsored a conference in Philadelphia in February which was attended by five senior figures of the World Peace Council, headed by a Soviet member of the WPC's presidium, E. K. Fedorov. It is worth recalling that the leading Soviet dissident, Andrei Sakha-

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rov, has given warning "that there exists a political interest on the part of the Soviet Union in exploiting—and therefore in creating—energy shortages in the West." (*Bulletin of the Atomic Scientists*, July 1978.)

THE ATTITUDES of individual Communist parties within the world movement are an interesting reflection of the imperfect control Moscow now exerts from the center. Generally speaking, the stronger the party and the clearer its desire to appear independent of Moscow, the more likely it is to stand aloof from the anti-nuclear movement. The weaker the party and the more dependent it is on Moscow, the clearer its commitment to the environmentalist cause.

Thus the powerful French Communist Party (PCF), in its current "Eurocommunist" mood, has become curiously "responsible" on nuclear policy. The Communists stayed aloof from the violent anti-nuclear demonstrations of July 1977 near Lyons, and a prominent local Communist, Paul Rochas—a member of the Party's Central Committee—declared: "We once again condemn violent acts organized by groups outside the country which use the anti-nuclear label as a cover. These two days will not have provided any solution to the real questions. The Communist Party will continue its responsible policy of providing the country with a national energy policy, carried out with all the security measures and contributing to the future of France and the well-being of her people."

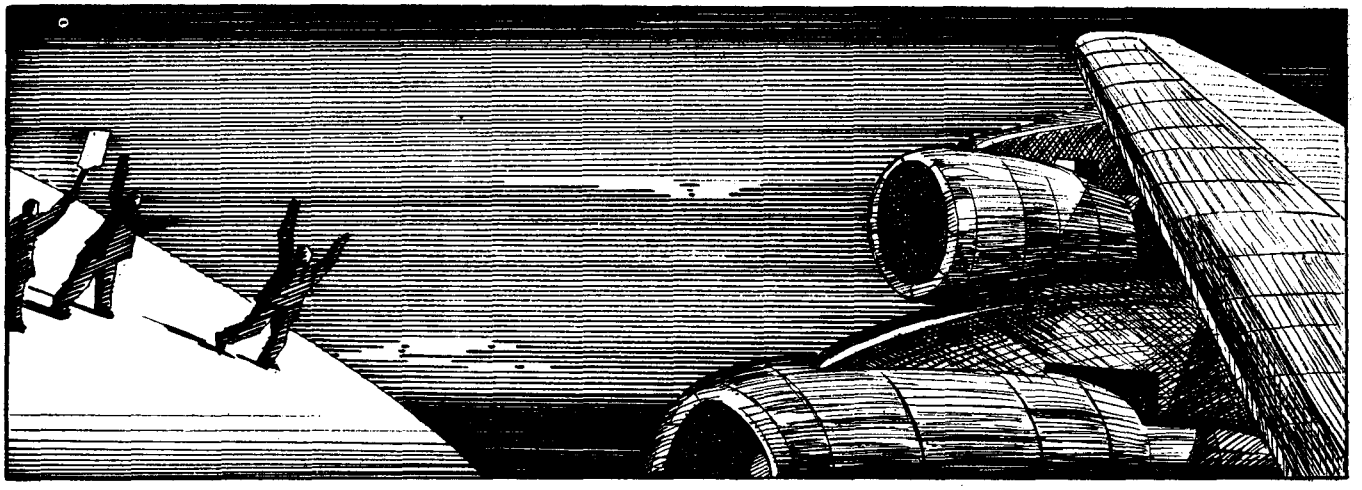
This robust and responsible attitude, however, is not the kind of luxury that can be afforded by the smaller Communist parties. For instance, the Swedish Left Party (VPK) and the Danish and Norwegian Communist Parties are all hostile to nuclear power, and the same is strikingly true of the West German Deutsche Kommunistische Partei (DKP), which is essentially a subsidiary of the ruling East German SPD—East Germany being, of all the East European satellites, the one most closely controlled by the Soviet Union. There is an interesting contrast between the East German regime's commitment to nuclear power while its subsidiary in West Germany opposes it there.

The violent anti-nuclear demonstrations at Brokdorf (near Hamburg) on November 13, 1976 were largely financed from East Germany—that is, indirectly, by the Soviet Union. In January of 1977, the authoritative *Frankfurter Allgemeine Zeitung* stated that the East Germans had provided 100,000 deutschmarks for the infiltration of the anti-nuclear movement in West Germany. The East Germans have not even bothered to hide their involvement. For instance, in mid-December 1976, Gerhart Schuerer, chairman of the State Planning Commission, said in East Berlin that "disruptive activities against the construction of atomic plants in the capitalist West, especially in the Federal Republic, must be promoted. Trained provocation units [*Stoergruppen*] have been dispatched." (*Frankfurter Allgemeine Zeitung*, January 27, 1977.) On February 2, the West German Interior Ministry confirmed in the Bundestag that it had firm information about East German support for the anti-nuclearists.

An active instrument in the infiltration of the anti-nuclear movement from East Germany is the Institute for Marxist Studies and Research, set up in 1968 in Frankfurt by an executive committee member of the West German Communist Party, Dr. Josef Schleifstein. The Institute has tried to involve the Communist, pro-Moscow Swiss Labor Party (successfully) and the French Communist Party (unsuccessfully) in its anti-nuclear policies.

As long ago as 1954, the Japanese Communist Party (at that time of course pro-Moscow) immediately infiltrated the newly created Japan Council against Atomic and Hydrogen Bombs (GENSUKO). Soon the Japanese Communists had succeeded in broadening the movement to oppose "imperialist policies" in general and to support "national liberation movements."

IT MUST be said, however, that in Japan, as in Germany, France, the U.S., and elsewhere, the main political initiatives have been taken by Trotskyists and "Maoists" (the quotation marks have become essential at a time when Maoism is being discredited in China). For years, however, the Russians have been infiltrating, and in some cases have established control over, such groups, and for years they have offered arms, money, and training courses for terrorist groups, a number of which are involved in anti-nuclear protests. The fact that Trotskyists and Maoists appear to be more active than pro-Moscow Communists in the anti-nuclear movement is therefore not in itself evidence that the Russians have clean hands. In any case, the evidence of Soviet involvement, though not abundant, is conclusive. □



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THE USSR

Meanwhile, in the Soviet Union . . .

WIL LEPKOWSKI

LENIN, in his time, gave a great deal of thought to the physical sciences. In seeking to fulfill the Communist dream of social justice and human unity, he saw miraculous possibilities in the electron. One of his slogans (prominently displayed on the red outdoor banners that bedeck Moscow) is: "Communism means Soviet power plus the electrification of the whole country." And he meant this very literally: to him, the electron was an "inexhaustible" bit of matter that would unify the Soviet masses from the Pacific Ocean to the Polish border, across eight time zones.

A breathtaking vision. And the surprising thing is how far the Soviets have come toward making it reality. One-third of the USSR is now on a single electrical grid (although, as of yet, a very small percentage of its electricity is generated by nuclear reactors), and Soviet technology for long-distance transmission far exceeds anything we have in the West. Now they are about to streak toward the completion of that electrification process through nuclear energy. It may still be folly to think anyone could unify the 150 Soviet cultures, divided among 15 separate, historically jealous, Republics. But vaulting technological ambition in the USSR is something to see.

From mid-September to early October, I was part of the first American press tour ever of centers of nuclear energy in Soviet Russia. The results of the tour have already been widely reported in both the technical and the popular press, and what I have to offer here are some post-trip observations on the Soviet approach to fulfilling the dreams of the peaceful atom. ("May the atom be a worker, not a soldier," is another Soviet slogan.)

What is clear is that the Soviets are pushing the atom and pushing it hard. And while their program is by no means the biggest in the world, it can easily be said to be the most dynamic. By the year 2000, it will be the biggest.

This isn't to say it is the wisest, given the considerable security problems connected with nuclear proliferation and waste disposal, but it does seem to be the most pragmatic and probably the most creative; and it enjoys a popular consensus even in the context of Soviet society—the dissidents are for it, too.

By American standards, the Soviet program is quite minuscule in terms of megawattage generated. Soviet nuclear reactors produce only 8,000 megawatts of power today, or around 3 per cent of the total Soviet electrical capacity. By contrast, nuclear energy accounts for 52,000 MW, or about 12 per cent, of the total U.S. electrical supply. Moreover, Soviet plans for expansion continue to lag along with the rest of the economy—which by their own admission is tightly inter-connected with the economies of the West, and which is chronically beset by labor shortages, worker slowdowns, shipment delays, and every other form of inefficiency characteristic of a top-heavy state bureaucracy.

But the important factor to recognize is that the Russians know what their problems are. And while they hate hearing about them from outsiders, they listen to criticism and work to make corrections.

THERE ARE really three places to go for a first-hand look at the Soviet nuclear program. First, go to Novovoronezh, three hundred miles southeast of Moscow on the Don River, and talk to Vitaly Sedov. Sedov is a rather grumpy nuclear engineer who runs the big five-unit, 2,455 MW power station there. (Dedication ceremonies were held in December to start up the fifth unit, whose construction was being completed during our visit.)

Sedov entertains hundreds of Western visitors a year at Novovoronezh because his station has the country's most up-to-date display of nuclear capability. There are a couple of 1,000 MW units near Leningrad, but these are said not to be working very well, and they may look a bit clumsy in design to Western eyes. The reactors at Sedov's station, however, are first-class, and their control panels are very impressive indeed. But the most important feature for Westerners is the big concrete dome around unit five—a containment vessel.

Sedov says he didn't much enjoy spending the extra millions of rubles it cost to construct the dome, designed, as Western nuclear people know, to confine the escaped radiation in case of an accident. He and his fellow engineers by and large believe Russian reactors are safe enough without containment domes, that enough safety precautions have been taken to satisfy the most finicky inspector. Nevertheless, international safety guidelines require containment vessels, and the Soviets know that if they want to export their reactors to the West in return for much-needed hard currency, they will have to supply the containment as well.

Strangely, the Soviets don't seem too pleased over U.S. antipathy toward nuclear growth. [But see also "Power and National Sovereignty," by Brian Crozier, p. 164.] It is as if they view themselves as having a protective stake in our future trajectory. They would like to see us arrange for a slow and peaceful transition to Communism without causing trouble for anyone, especially themselves: they want capitalism to die without a war that could come about through social stresses caused by economic decline and energy shortages. Meanwhile, they would like to get hold of as much of our technology and know-how as we can give or sell to them, especially computers and oil drilling equipment.

The second place to go is Obninsk, site of the Institute of Physics and Power Engineering, about sixty miles southwest of Moscow. This is where most of the research on breeder—or

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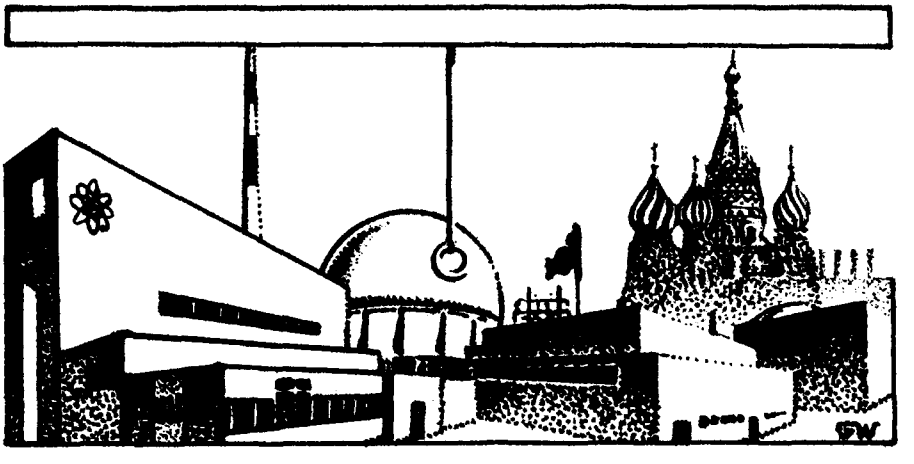
high-neutron-flux—reactors is done. Obninsk is a treat to visit—the scientists and engineers there are generous with information, and you come away with a high regard for the breadth and ambition of their breeder technology.

At Obninsk we were given details on almost every breeder developed in the USSR, and we were informed of future plans as well. The first breeder to generate electric power was built at Obninsk 25 years ago (a 5 MW unit), and it is still generating power. Various other experimental devices were built over the years, including small units for generating steam in the Siberian permafrost. We were briefed on the BN 350 that is operating at Shevchenko on the Caspian Sea, designed for electric power and the desalination of water. We were told the BN 600 (600 MW), at Beloyarsky in the Urals, was about to begin operation. And by the late 1980s, the BN 1600 (1,600 MW) is slated for operation somewhere in the western USSR. (This one is still on the drawing boards.)

Breeders, of course, are troublesome—the BN 1600 is several years behind schedule—and the Soviets really don't say much about their troubles, being persistent optimists. The technological infrastructure around breeders is immense and implies a still unfathomed pool of adaptive problems, both social and economic. Debate over the ethics of breeder development is kept under wraps. The only permissible debate is over improving production schedules. So all one can really do is report on what the Soviets are doing and what they plan to do. And their plans are ambitious.

The third place to visit is Volgodonsk—but here, even if they let you in, you shouldn't expect to see much. It is still all excavations, except for one big building for making tools. Volgodonsk is the site of "Atommash," where the Soviets plan to mass-produce reactors. However, it is years behind schedule: we weren't allowed to go there but, at intelligence briefings, we were told of the difficulties the Soviets were having with it. Still, Atommash is a key to the future of both their atomic exports and their internal development, and it will get finished. But at what price is only conjecture, given the severe problems in the Soviet economy. The pity is that American journalism has carried so few reports on Soviet technological plans and development. To my mind these are the best indicators of comparative stature and future trajectories.

The Soviets' major reactor export item is a 440 MW unit—several satellite countries have already bought 440s, and Libya and Cuba have them on order. The Finns have bought a couple of 440s too, and in a visit to the site at Loviisa the Finns told us they were well pleased with the product. They paid $250 million for the first Loviisa reactor, which is anywhere from $50 to $100 million more than they would have spent on a comparable model from the West; to sweeten the deal, the Russians offered free fuel enrichment, free waste disposal, and an interest-free loan. The Finns confess to having experienced some quality-control problems—mainly having to do with weak welds in the cooling system—and they are bothered because the Soviets won't show them the quality-control procedures they use in manufacturing. But technologically it is a good reactor; its design and color patterns are aesthetically pleasing; and the Finns are happy to show it off. How many more 440s the USSR is able to export will depend a lot on the troubled Atommash. Some are being made near Leningrad for export to Communist countries, and the Soviets do see an expanding Third World market for reactors of this size. But as far as sending 440s to any more Western countries goes, an observer has to be extremely dubious.



THE BIG difference between the U.S. and the Soviet Union is in their attitudes toward atomic power in general, and plutonium in particular. Our Administration calls nuclear power the technology of last resort. Not so the Soviets. They see it as being of prime importance. To the Soviets, plutonium is a fact of the present and a fact of the future. They deal with it, plan for it, and tell internal antagonists to shut up. The same for nuclear wastes; Siberia is a big place with lots of geological formations where the stuff can be buried, and never mind the big explosion at a nuclear waste burial ground in the Urals in 1958. (It would be nice if Soviet scientists got up one day at an international meeting to explain exactly what happened and why.)

There is one other place to go for a sharp look at the Soviet past in nuclear development and for another look into the twenty-first century. This is the Kurchatov Institute for Atomic Energy near Moscow, named for Igor V. Kurchatov, founder of Russia's military and civilian nuclear program. Part of any visit there includes a tour of his residence, where you see the silverware he ate with, the bed he slept in, the bathtub he soaked in, and old films of his speeches before the Soviet Supreme Council. He died a hero, in 1960, and a monumental granite bust of the bearded Kurchatov reviews the traffic circling the plaza in front of the Institute.

At the Kurchatov Institute you discuss the Soviets' development of conventional reactors—pressurized water reactors, mostly—and the ins and outs of coolants, safety systems, new alloys, gas-cooled-reactor technology, boiling-water-reactor technology, and the like. You also see Tokomak.

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Tokomak is the technological gem in which the Soviets demonstrated the feasibility of controlled nuclear fusion, wherein two hydrogen atoms fuse to produce helium, releasing vast amounts of energy in the process. The Soviets are working on an upgraded version of Tokomak—the T-20—but concede that the Americans are now ahead of them. Last summer a group at Princeton reached record plasma temperatures in their own counterpart to Tokomak. But everyone agrees that maintaining the needed temperatures of 60 million degrees Celsius for long enough to start a self-sustaining reaction will require experimental machines that no single country can afford. So the Russians are proposing a joint U.S.-European-Japanese-Soviet effort to make fusion a reality by the early decades of the twenty-first century.

Of course, Soviet nuclear power shouldn't be regarded in isolation, apart from that continuum on which science, technology, and international affairs merge. The territory is largely unexplored, but it is one that anyone seeking to understand Russian-American relations ought to factor into his assessments.

Most people are stumped when asked to name the most sweeping Russian contribution to the natural sciences. In fact, towering above every advance in physics and mathematics made by Russians was Mendeleyev's discovery of the atomic table (actually a creative logical design of chemical relationships more than a discovery); it set the stage for the enormous take-off in experimental science. And it was not merely fortuitous that Mendeleyev was a Russian: his atomic table was a product of Asian thought rather than Western science, in that it sought to find patterns in a whole rather than to accumulate order within smaller and smaller parts of an object or phenomenon.

That tradition continues. The Soviets still aim to think and plan in wholes; they devote entire institutes to that process, and their science is goal-directed. It is often clumsy, as all scientific discovery is when in process. But it seeks to integrate; and Soviet energy policy—which means atomic energy—is part of the picture of that whole that struggles toward integration. □

The Need for Growth

LET'S GO to the ZEG party! That's Zero Economic Growth to you, a first cousin to ZPG (Zero Population Growth), and another adopted child of the dubious union among the Ford Foundation, Stewart Mott, and other monied seraphim of the established Left. Not much fun, you say? Why not? What's more fun than a tax-exempt barrel of bearded social democrats fearfully talking of power plants as if they were bombs? Vegetarians in leather jackets drive their imported cars to Seabrook listening to the Grateful Dead on their Japanese tape decks amid a marijuana haze.

There is no reasonable case against economic growth. All the attempted arguments turn back on themselves. Economic expansion is indispensable, for example, to fight pollution or to develop alternative sources of fuel or to create a new "soft energy system." The mandate of "beautiful smallness" is best fulfilled in the semi-conductors and microprocessors that are our leading industry of growth. To relieve the world's hunger and promote development in the Third World, we will need unending economic boom and technological creativity in the West. It will take vast economic gains even to pay for the indexed pensions and medical needs of the coming generations of zealously childfree codgers and crones.

In any case, the significant peril comes not from the ZEG fanatics, but from suave advocates of growth whose policies are now bringing productivity gains in America to a halt. The real ZEG party is in Washington and consists of men who think you can have progress against poverty without a growing gap between rich and poor; who imagine that you can reap the benefits of capitalism without permitting large concentrations of personal wealth; who think government can "create" work through jobs that produce far less than they cost; who prattle about human rights while resisting immigration from Mexico and Southeast Asia, as if it were a threat rather than a precious resource of liberated human energy and spirit; who want growth but whose planning smothers it.

All government planning must be based on what is already known. It tries to create a safe and secure society by "rearranging our known reserves," redistributing our existing wealth, reusing our measurable waste, reorganizing our current population. This effort cuts off the spontaneous energies, unplannable innovations, and disrupting immigrations—the supplanting of the known by the new, of established industries by unpredictable challengers, of risen poor by poverty imported from afar—on which growth always depends.

The deeper problem is religious. No society can long grow if it fears the unknown. The secular sensibility is terrified by the void, quakes pathetically before the mystery, fecklessly refuses to face the indeterminacy of human life. Therefore it tries to plan and control and suppress and domesticate the inevitable darkness before it. All progress, though, depends on faith, a willingness to plunge into the darkness and find the redeeming light. Growth depends on worship of what we do not know, on penetrating the opacity of now to reach the luminous reality beyond, on the willingness to accept the risk of failure and death in order to uncover the unknown gifts of Providence.

The proponents of ZEG—like the primitive ungrowing societies they so revere—worship little that they cannot see and feel. Our bodies, ourselves, the sun. Even children often seem dangerously unpredictable to them. Everything beyond their ken is assumed to be conspiratorial or carcinogenic. If this attitude were confined to the radical Left we could merely deride it. But it expresses the deepest potentialities of the secular-humanist world. It is the timorous and paralytic vision that lurks behind the great stone face of Washington bureaucracy.

—GEORGE GILDER

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Nature's Law & Nature's God

IN THE current struggle environmentalists are maintaining, we must recognize a gamut of motivations —love of nature, fear of disease, dislike of waste, the anti-porkbarrel sentiment, pacifism (the anti-Vietnam War kind), a characteristically American form of nostalgia, and just plain romanticism. None but the most crass opposes such environmentalism as connotes a concern that our natural habitat not be irreparably or even sorely damaged by individual fecklessness, industrial development, or irresponsible government planning. The recently enacted New York doggie law, and the final killing, by Congress, of the proposed Mineral King Development in the Sequoia National Forest—a destructive porkbarrel venture that would have cost $80 million—are two clear, if disparate, environmental victories.

Running through the whole environmentalist movement, however, there is a very strange strain of "back to nature" and "no growth" (henceforth: BTNNG). I call it strange for a variety of reasons. It is not in the American tradition, which favors maximum growth and development of our worth, making as much money as one reasonably can, and the competitive pursuit of personal happiness. Further, the dogma would obliterate so much that the Western world has achieved by rational thought and scientific enquiry over seven hundred years, substituting for the one a soggy romanticism, for the other a benign fatalism laced with fatuity. And, besides requiring us, by one estimate, to liquidate some forty to sixty million of our fellow Americans (since, under its norm of "organic" food, they could not be fed), it would surely prepare all of us who remained for an Orwellian anthill existence.

But BTNNG reaches beyond the material and secular: it extends into the religious order, where it is in absolute opposition to traditional Christianity and Judaism. Many refer to it as an ethos. The truth is that it is a whole theology. In fact it is nothing if *not* a theology: because the definitive arguments put forward in its defense are theological. Without these arguments, BTNNG would easily be dissipated over time by the cold hard facts of economics, culture, and politics.

BTNNG comes out of a confused and murky recent past, although its remote roots lie back somewhere in popularized forms of New England transcendentalism and in the purple lattices of dreams dreamt on the shores of Walden Pond. But the first vivid traces of BTNNG appeared after World War II, initially in Britain, then in the U.S.A., as reactions to the development of the A-bomb and H-bomb. It had its first guru in Rachel L. Carson, who painted a hypnotic picture (surely as great a hoax as any perpetrated on the culture) of an America sans birds, sans bees, sans fish, sans any living thing, really. Then the floodgates of the Sixties opened with waves of communes, the flower children, the back-to-nature groups, the antiwar protests, the profitable organic food business, the profitable drug culture, the great and profitable TM of the Maharishi, the neo-Buddhism and the Cockney Zen and the Aikido of the West Coast.

All through this period, there flowed a river of books and treatises in which—slowly, patiently, deliberately —the theology of BTNNG was formulated and assumed its present contours. It is now offered as a complete system for believing and living. What Christians and Jews used to know as the good earth created by the good God is actually a liferaft, a lifecraft—a spaceship, according to BTNNG: an ecosystem organized by the flow of energy through it.

"Everything," as an ad for one BTNNG organization declared, "is connected to everything. Everything's got to go somewhere. There's no such thing as a free lunch."

What is that energy?

BTNNG-ers love to quote Teilhard de Chardin: "Everything falls into the ocean: energy, the new spirit, the new God."

R. Buckminster Fuller reformulated this, as is his wont, in a hyped-up metaphor: "God is a verb, connoting the vast harmonic reordering of the universe from unleashed chaos of energy." Spaceship Earth, as a contributor to *The Last Whole Earth Catalogue* wrote, is ideally "a planet on which the human population lives harmoniously and dynamically by employing a sophisticated and unobtrusive technology in a world which is left natural." And Wendell Berry deftly rounded all this off: "Man's only real freedom is to know and faithfully occupy his place—a much humbler place than we have been taught to think—in the order of creation . . . us two-leggeds [sharing it] with the four-leggeds and the wings of the air and all green things. . . ." BTNNG has no use for the creation of Earth and of man in it by a loving, personal God Who saves, and Who has given Earth into man's stewardship.

AND WE humans, what are we? Every one of us is the result of four forces: the condition of matter/energy at our birth; the biology of the species; our genetic heritage; the culture we are born into. Once born, you are brother to the boulders, sister to the stars. Period. Excluded is any idea of man as possessing a spirit, an immortal soul created by a loving God and differentiating men and women forever from all else in this world. You are merely the biological pinnacle of vertebrate animals. *So Human an Animal* is the title of one BTNNG manual.

What happened to Lifecraft Earth, before BTNNG got going? Well, very briefly, rotten ecotactics. Lifecraft

Mr. Martin is NATIONAL REVIEW's *religion columnist and a former professor at the Pontifical Biblical Institute in Rome. His most recent book is* The Final Conclave.

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Earth became a degraded ecosystem governed (ravished, rather) by "the lotus-eaters of this era [who] are in Washington, D.C."—by industry, factories, armaments, American imperialists, the almighty dollar, Wall Street, mass production, the oil companies. All who Think Big. In short, the Complex against which the BTNNG Guru, Baba Ram Das—né Richard Alpert, a former associate of Timothy Leary—hurled the ultimate reproach in 1970: "The fear of death is the prime motivating force in this country at the moment." This is the only real evil at the heart of human things, the real propulsive Original Sin, from which all our sins and miseries flow, the evil which causes us to ravish our habitat.

What, now, can we do? There is no question of any *saving* action by the God of Hebrews and Christians. Earth, after all, is *our* Spaceship. It is up to *us*. "You can only love life," Baba Ram Das has warned, "when you love death." And it starts in our own heads. We have arrived at an opportune moment for our consciousness to participate in the supreme evolution. Man, wrote Teilhard, "is evolving into a superabundance of mind in the noösphere where the All and the Person are One." We have to prepare for our total demise so as to achieve the All . . .

What is the first step? A realization. We have to learn, says *The Last Whole Earth Catalogue*, that "at the heart of things there is some kind of serene and ecstatic process which is actually beyond qualities and certainly beyond birth and death." (How a "process," which is admittedly not personal, especially as God is now a verb, can be serene, or ecstatic—or both at once—is nowhere addressed.) We have no need even to survive. All we need do is "bring up our children as part of wild life," so that we all evolve into a "new kind of family—responsible but more festive and relaxed."

This is all very different from the bipolar view of life advanced by Jews and Christians: good and evil, God and Satan, the struggle for the possession of the soul of each individual and of human society. No serene and ecstatic process that, but a battle cosmic in its scope, yet excluding no individual.

BTNNG, of course, has its own type of individualism. As the title page of *The Last Whole Earth Catalogue* puts it, "we are gods and might as well get good at it. . . . Today we are entering the realms of intimate personal power —power of the individual to shape his own environment."

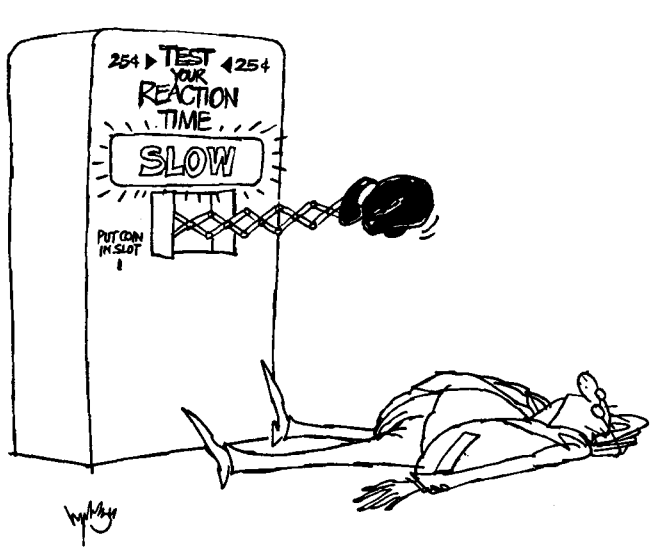
With all that in mind as step one (and remembering to practice so we get good at being gods), we proceed to steps two and three, which are all about shaping the environment. We decree and effectively inaugurate zero growth in economics and industry. We must Think Little. This immediately involves the third step: back to nature: a do-it-yourself existence involving everything from biodynamic gardening, compost heaps, excreta disposal, weaving, and soil testing, to midwifery and a vast natural lore about the world goat population, knots, simple mining, Canadian honkers, hydroponics, animal traps, edible soy bean, duck corn, simple burial techniques, and everything else we need.

AND HOW does it all—we all—end? Well, as Teilhard wrote: "The breakpoint is where man is God and God is man, where all layers of the noösphere become involuted, fusing and consuming the All and the Person integrally in Itself."

In its concept of man's destiny there is no room for the Children of Abraham's Covenant, with its promises, its exclusive blessings; and certainly no place for the historical Jesus of Christians who—Christians have always claimed—directs and controls the intimate details of all human history toward the final days of His Universal triumph through love. BTNNG implicitly derides any promise of an eternal life in the fullness of consciously felt love, of absolute truth perceived fully, of infinite beauty enjoyed endlessly. Instead, as in the bastardized varieties of Buddhism to be found in Bay Area ashrams, we are destined to sink with all other things into the Great Well of nonbeing, which is presented as a positive nothing. You may be nothing; but be consoled, you will be everything else too! Rachel Carson's nightmare was bland by comparison; for here is the dream of a world without divine friend, without eternal home, without grace to live gracefully, without reason to be honest or pure, or even to live.

You can think about this entire mixtum-gatherum of parasitic theology, false economics, misunderstood Buddhism, and intellectual degeneracy for quite a while, and then dismiss it as a negligible lunacy. Even when it instigates effective political actions and modifies our economic conditions, you may still dismiss it. But recent events in Guyana should warn us that at no time in his history has man been such a lethal problem to himself as he is today. Many must have laughed at the lunatic magic of Jimmy Jones and his particular theological farrago of mysticism, Marx, and monomania. Many more used it irresponsibly for their own political ends. And, too, many were duped and done to death. But any religion so malleable—including BTNNG—could, in its own way, entail much suffering, even death, for millions. For its so-called theology could be an effective way of undermining not merely our way of life, but all reason for living.

"For my part," one follower of Jones wrote in what should be a warning to us all, lest it be a dark and confused epitaph for many, "I am more than tired of this wretched merciless planet and the hell it holds for so many masses of beautiful people. Thank you for the only life I've known." □



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ECO-CHIC

Small May Be Beautiful But Will It Move?

S. K. OBERBECK

"LAKE ERIE. Dead." She says it triumphantly, between healthy mouthfuls of *fettuccine alfredo*. "Dead." As her elders would have spoken of a setback in Vietnam. She's working pretty good on the Soave too: somebody's dewy daughter home from Academe's angry wars.

"Howdya mean, dead?" Her escort. Skeptic; drone.

"Dead. Completely polluted. The fish are all dead. Or poison to eat. Their *food chain* is gone, destroyed. All that *sewage* and industrial *wastes*."

"It's in *our* food chain too. Toxins." Extra-cheese pause. "And they want to build the nukes. To make more poison. It's crazy." I look at my partner, who jogs maternal eyebrows pleadingly. So I just sit and listen as the lecture unfolds, checking bibliography. The Holy Trinity: Nader, Commoner, Ehrlich. She knows her catechism: Lovins, Toffler, Lennon. She doesn't know that Lake Erie is alive and well. She's a Clamshell Alliance cutie. But don't get on the wrong side of her Vibram hiking cleats on Demo Day.

"Who gets the check?" the waiter wants to know. Welcome gavel. Court adjourned. Bailiff will accompany convicted Capitalism to the wall. No blindfold. And thank you for not smoking.

Yeah, I think: exactly—who gets the check?

Yeech! Garbage. Sewage. WASTE. POISON. The End.

You turn on the tap. And out oozes this disgusting, putrid, green, crawling slime. Filthy. Yeech! It glops out, gurgling like some hellish, stinking death molasses. Throbbing. It . . . God it suppurates over the sink bottom, clogs the drain, spatulates up over the edge, swelling . . . toward you! The End.

The waste sensation puts most people down at the sharp end of the worry stick. Pollution. Towering, Felliniesque municipal and industrial wastes. Carcinogens. *Mutagens*. End.

So the doomsday myths proliferate. Creeping societal emphysema; choking in our own mad techno-excreta: neutron bombs, screaming SST, gas guzzlers, cigarettes, black lung, booze, additives, hard drugs, falling safes. The perils. An SRO globe moribund. The horror. We run. We bike. We hike away anxiety, smug in goose-down vests.

But the nuclear question: oh boy! The Big One. Atom Bomb! The real unknown: Hiroshima. Firestorm. Fallout. Half-lives. Forget your Santa Barbara blowout, the gassed Utah sheep, Minamata's mercury death, or poor old late Lake Erie. Preludes. Overtures.

Plutonium. Sinister, right? Roman death god. Dark regions. Outermost planet. Chilling. And melt-down, leakage, death-cloud, WASTE: marrow-gobbling, lethal for thousands of years. And breeders. No, *fast* breeders . . . God, it sounds like some Nazi stud farm. Oh sure, they say just box up the waste and bury it. Drop it down salt mines. In glass *coffins*. Or (get this!) into underground caves blasted out by, yeah—ATOMIC BOMBS! Too much. I mean, Dr. Strangelove, meet Rosemary's baby.

What if there's an earthquake? Or terrorists take over? Jesus, just a whiff'll kill ya. You can't prove it'll never happen. Don't forget we almost lost Detroit . . .

Maybe there's no antidote—no rational antidote. Still, it's incredible: in an age of Science and Technology (their devils *must* exist), myths predominate, misinformation rules. The media make it worse, by and large, spreading the confusion. (Here's one clarity that the U.S. media ignored: "It's difficult to explain to a layman that a nuclear reactor is not a bomb, that coal- and oil-fired plants are a far greater danger . . ."—A. Sakharov, physicist.)

Behind the phony "debates" and spurious "information," cause-industry demagogues stir cauldrons of hand-wringing emotion and Clamshell chicanery. De-development. Think soft. Think small. "Famine—1975!" (*But we must feed the Third World!*) Union of *Concerned* Scientists. Friends of the Earth. (Friends?) Dehumanizing consumerism. It may be rampant irrationalism, economic and political, that truly plagues us, makes us run, hike, escape.

Yesterday: the War, grapes, and lettuce. Today: eco-chic, wood stoves, sunbeams, and Off the Nukes! Same old alliances: the Palmetto, Yucca, Ptarmigan, Sandhill Crane. Same old placards: Proliferation. Escalation. Snafu. Megadeath. Burnt babies. No choice. Just Eco. Furbish lousewort and snail darter, and let's fix the famine. Without fertilizers or pesticides, however. We are your (nature) children!

OVERCOMING popular, public myth may be Democracy's final battle, observes French nuclear expert Marc Geneste. He fears that "the perpetual collision of rational expertise versus public emotion in free societies" will have catastrophic effects. The USSR refines its breeder reactors at will. We get MAD and have SALT rubbed into psychic wounds. The Kremlin leaders parade their awesome arsenal. Our last May Day: Sun Day 1978.

Recently a *New York Times* editorial exulted over a beamish federal report on solar energy, hoping it could "slow the spread of nuclear power technology"—the very spread that lowers cost. Eco-chic.

Finally, I note that Abbie Hoffman has changed his mind. The Domino Theory was valid, after all. "Stop the War" wasn't such a great idea. We should have stopped them in South Vietnam. Sorry, fellas. We all make mistakes.

Yeah. But who gets the check? □

Mr. Oberbeck was a critic for Newsweek *for ten years, and is now in corporate public relations.*

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The $200-Million Delay

The Lawmakers

M. STANTON EVANS

IF JUSTICE delayed is justice denied, then hope of equity in the legal handling of nuclear power may be abandoned. Opponents of the peaceful atom have turned the tactic of postponement into a lapidary art.

Naderites, Friends of the Earth, and others who want to slow development of nuclear energy have proved themselves a litigious breed, resorting doggedly to courts and regulatory processes to hinder the licensing and construction of nuclear plants. In this pursuit, they have been greatly aided by a maze of contradictory laws and regulations, and an overlap of jurisdictions which permits the filing of parallel complaints, lodging the same complaint in different places, or a continuing sequence in which an issue laid to rest in one place is reincarnated in another.

In a typical hassle over construction of a nuclear plant, an electric utility may have to deal with state public-service, environmental, or other agencies; the Federal Nuclear Regulatory Commission; the Environmental Protection Agency; and various state and federal courts. Protests can be lodged with any of these entities—resulting in an order to suspend operations until the question is resolved—and frequently issues settled at one level can be opened again at another. This procedure can drag on for years (and has done so), resulting in an enormous increase in construction costs and interest charges. These increased costs are then invoked by the opponents as decisive evidence that nuclear power is too expensive.

It is estimated, for example, that construction of the proposed nuclear plant at Seabrook, New Hampshire, has been delayed at least two years by regulatory intervention, at an added cost of $419 million in construction outlays, plus many other millions in losses to the state economy. The American Council on Nuclear Energy calculates that regulatory constraints extend the period from contract award to completion of a nuclear project by almost three years on the average, at an increased cost of $200 million per project.

"For plants coming on line in 1976," says the Council's legislative director, Edward Davis, "the average duration from receipt of construction permit to fuel load averaged 96.7 months. Engineering estimates of the actual time required to construct a facility [are] about sixty months and this is consistent with the time required to construct similar facilities overseas. This means that the licensing process adds approximately 37 months to time required to build a nuclear facility."

Paradoxical Bundle

In an effort to cut this Gordian knot, officials in the Carter regime and Congress have been trying to write a bill on nuclear licensing reform. Last year the Administration sent up a proposal that contained some good features, but also contained some bad ones. After doctoring in the House and Senate, this proposal emerged as HR-11704 (Representative Morris Udall of Arizona) and S-2775 (Senator Gary Hart of Colorado)—a curiously paradoxical bundle of legislation. In an effort to please all sides, Udall-Hart attempted to promote efficient licensure on the one hand and augmented public intervention in the regulatory process on the other. Predictably enough, the total package was pleasing to no one.

The positive feature of the Administration's proposal was its effort to eliminate regulatory duplication and resultant openings for dilatory tactics. Among the leading provisions of the bill were sections 1) specifying that once a determination of need for additional energy has been made by the relevant state agency, it doesn't have to be made again and again; 2) allowing the NRC to issue combined construction and operating permits, rather than treating these as separate regulatory issues; 3) limiting hearings to issues which have not been raised and settled in earlier proceedings; 4) providing for development of pre-approved sites, thus eliminating the need for hearings each time a site is required for construction of a nuclear facility; and 5) permitting standardized reactor design to avoid the necessity of having each individual reactor approved in a *de novo* proceeding.

Break the Logjam

While these and other aspects of the legislation were pointed in the right direction, additional features of the Udall-Hart proposals were less pleasing. For one thing, they contained provisions for tax-supported intervention in the regulatory process, and this proviso would encourage the very delaying tactics the legislation was intended to avoid. For another, the bill contained ambiguous language permitting the opening of the regulatory Pandora's box on the pretext that some "significant new issue" had arisen—the device by which opponents have dragged things out interminably at Seabrook.

Supporters of nuclear power want a licensing and siting bill, containing affirmative features of the Administration proposal, but with some of the bad stuff taken out. They want the tax-supported public intervention dropped, or at a minimum limited to issues which haven't previously been resolved. They would like to see the NRC empowered to issue interim operating licenses to circumvent diversionary tactics, provided appropriate safety standards have been observed. And they would like to override the power of state environmental agencies to impede development of the licensing process.

As the new Congress gets under way, the Carter regime, the nuclear industry, and opponents of atomic power are preparing to do battle on this subject yet again. With a little luck, spring or early summer could see some action to break up the regulatory logjam on nuclear power. □

Mr. Evans is a commentator on the CBS program Spectrum*; he also writes a column carried by the* Los Angeles Times *syndicate, as well as two columns for* NATIONAL REVIEW*: "Lawmakers" and "Dark Horses."*

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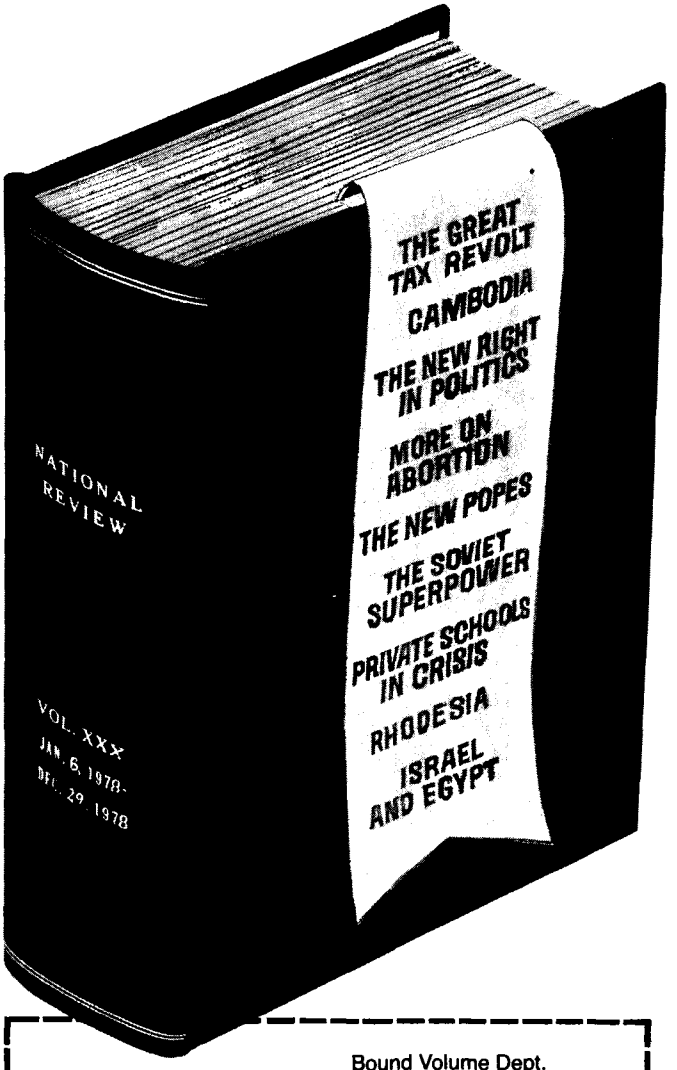

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Soft Brain Paths

SAMUEL McCRACKEN

The Poverty of Power
By Barry Commoner
Knopf (1976), 314 pp., $10; Bantam paperback, $2.75

Soft Energy Paths toward a Durable Peace
By Amory Lovins
Ballinger/Friends of the Earth (1977), 256 pp., $16.50 (paperback, $6.95)

The Menace of Atomic Energy
By Ralph Nader and John Abbotts
Norton (1977), 414 pp., $10.95

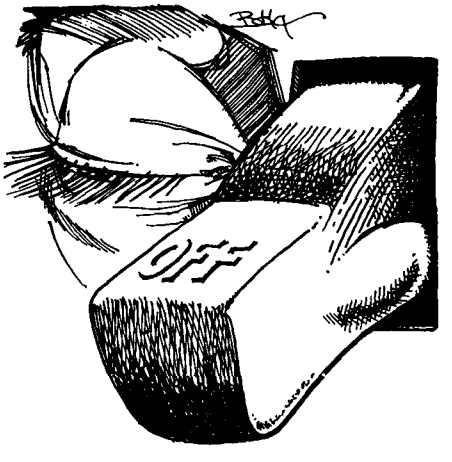
The energy debate is governed by misinformation stated and restated in prestigious and influential books by respected public figures. From the works under review, I want to cull a few beauties that suggest the quality of some of the most fashionable authorities. The case against nuclear energy is central to all three books, and for detailed discussion of that case the reader is referred elsewhere in this issue.*

Barry Commoner's first passion is for the second law of thermodynamics, which has been stated in many ways; his version distinguishes between indestructible energy and the wastable work that can be gotten out of it. If, for example, we know that even a maximally efficient thermal generating plant will waste about half the energy fed into it, we will be shy of using expensive and politically sensitive oil to generate electricity for space heating rather than using the oil directly and more efficiently in a furnace or a heat pump.

Commoner's concern for Second Law efficiency leads to grotesque conclusions. He argues that the atom is a wasteful source of electricity because its energy can be expressed in terms equivalent to millions of degrees, when all we want to do is boil water. But the temperatures in a reactor are not in fact much higher than those in a coal-fired boiler: the nuclear "fire" elegantly releases only the energy needed to heat the water in the generating plant, doling it out slowly from its vast store. On Commoner's logic, a diesel-propelled submarine is more efficient than a nuclear one, and a wood-fired one even better.

But he does not need thermodynamics to get into grotesqueries. Oil companies, he says, need capital to find oil, and must raise it from profits which may turn out to be excessive. Therefore we ought not to rely on them to discover and produce oil. We ought, apparently, to rely on someone else, the government perhaps, which can find oil without the use of capital.

Like many of the sun's uncritical friends, he lavishes upon it benefits-of-doubt from a stockpile he accumulated by denying them to conventional technologies. He compares the cost of solar space heating only to electric heating, the most expensive kind, and in no more rigorous a climate than that of St. Louis. His other case is Albuquerque, a sun-drenched city of one-story houses, which has an abnormally high collector area per capita. And finally, he gives no thought to the question of how the average householder will clear his solar panels of dust in the summer and snow in the winter. We may expect that in an all-solar economy accidental deaths from falling will increase sharply.



Commoner's use of special treatment is especially clear in a reference to hydrogen. Noting that "the *Hindenburg* disaster is a reminder of the serious hazards that are involved in handling hydrogen," he reassures us that "one recent engineering analysis states that, with suitable precautions, hydrogen used as a fuel '. . . should not be more hazardous than conventionally applied fossil fuels.'" He is less impressed by the *hundreds* of engineering studies showing that "with suitable precautions" nuclear fuel is *less* hazardous than conventionally applied fossil fuels. Solar energy is the environmentalist's pet, and he makes exceptions for it that he would not make for less-loved children.

* As well as to my own "The War against the Atom," in the September 1977 *Commentary*.

B. Bruce-Briggs *is a policy analyst and the author of* The New Class. . . . **D. Keith Mano** *is a novelist and* NR *columnist.* . . . **Samuel McCracken** *is Assistant to the President of Boston University. He is currently working on a book on the same subject as his "The War against the Atom."* . . . **Alan L. Miller** *is a frequent book-reviewer for* NR. . . . **William Tucker** *is a contributing editor of* Harper's *and has written several articles about environmentalism.*

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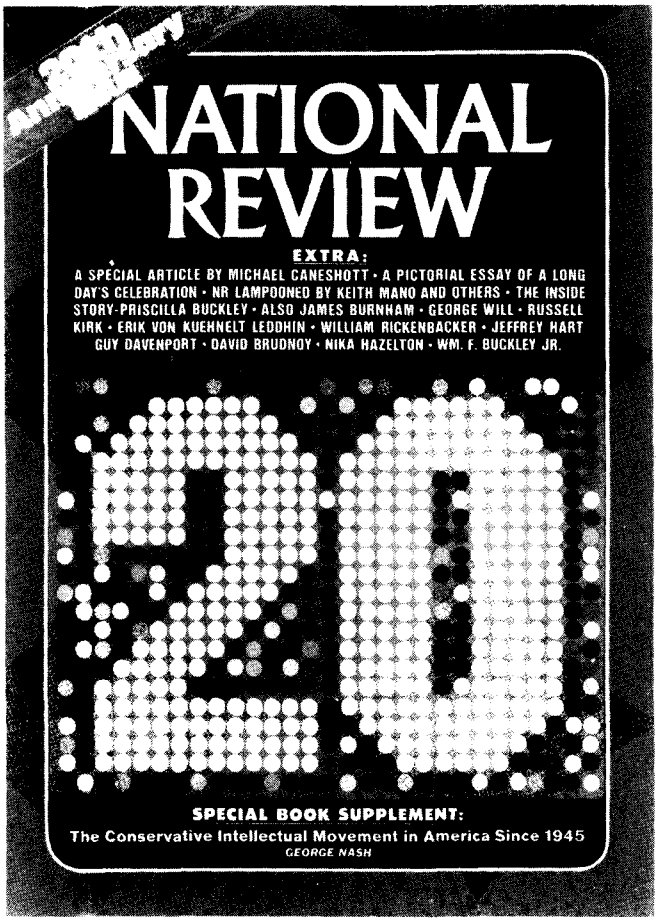
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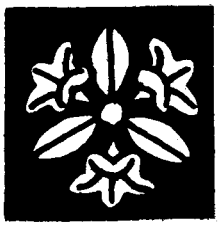
His discussion of transportation is a mixture of insight and more or less conventional railing against the automobile (he does appear to countenance filled taxicabs) and the airplane. It is hard to argue against electrified railroads, if you can afford to build them, especially when they can be driven by nuclear- or hydro-generated electricity. But lack of electrification is not what gave us Amtrak. Surely a major cause of the decline in passenger service is consumer preference for automobiles and airplanes.

Commoner discounts this, noting that the Europeans, even with cars and planes, crowd their trains. There is, he says, a "specifically American explanation for this effect." The explanation is that the American railroads are in the hands of capitalists who cannot make enough money off their passengers to provide them with attractive service. This explanation ignores the plain fact that the bloated capitalists once ran popular trains with superior service, and that nationalized systems suffer sharp declines in ridership.

More than that, Commoner ignores simple geography. The United States is very much larger and less densely populated than Europe. It is about as far from New York to Detroit as from Berlin to Paris, and from New York to San Francisco is seven hundred miles further than Paris-Baghdad! In such circumstances trains cannot compete with planes in any nation: Russians traveling between Vladivostok and Moscow do not take the splendid Trans-Siberian Express. They fly. The Express is for tourists making the whole run and Russians going part of the distance.



In one astonishing passage, Commoner shows how little claim he has to be listened to outside his area of professional expertise (plant biology). It bears close examination: lamenting the demise of the interurban trolley, he cites an episode in E. L. Doctorow's novel *Ragtime* involving a journey from New York to Boston by a trolley; the passengers

> board the No. 12 streetcar on the East Side . . . and three days later are in Springfield, Massachusetts . . . the fare . . . is a total of $3.40 for both from New York to Boston [$2.40 for the hero, Doctorow explains earlier, and $1 for his daughter]. Both enjoy the trip, as the electrified cars rocket through the countryside, the sights and smells unobscured by pollution.

One hardly knows where to begin in analyzing this mindless passage. To use "rocketing" to describe a *three-day* trip from New York to Springfield is to be ignorant of time and space. And whoever finds a bargain in a one-way full fare of $2.40, in 1910 dollars, New York-Boston, forfeits all credibility as an economic analyst. That trip would have cost half a week's salary. This is equivalent to about $100 in present-day terms, sufficient now to make the trip by first-class plane or train or by private car. One gathers that Commoner's acquaintance with wage and price indices is as slight as his understanding of the realities of travel. It is an unfortunate society that regards this performance as worthy of a prophet, let alone any sort of historian.

The attentive reader may well wonder how Commoner would enforce the sweeping changes demanded by his energy policy. There is a hint in his final chapter, which blames the troubles he sees on capitalism, with its unreasoning lust for profits. He thinks we ought to give socialism a try instead.

It is true, he says, that existing socialist—i.e., Communist—states have a bad record on political freedom (although we had Watergate, which he appears to equate with the Great Purge and the Cultural Revolution). But there is no inherent reason why this should be so. It is just a curious coincidence that without exception every Communist state is a repressive totalitarian dictatorship and has been so from its founding. Besides, there is Eurocommunism.

The cream of the jest is the notion that socialist states embody something known as "economic democracy," to which one need only add a generous dash of political democracy to attain paradise. Commoner appears to be unaware that economic decisions in a socialist state are made by a tyrannical elite kept in power by terror, and that the standard of living in advanced socialist states has not yet caught up with that of backward capitalist states.

Nor does Commoner notice that socialist states ignore his energy prescriptions. The Soviet Union is embarked on an ambitious program of nuclear power development at home and for export to its client states abroad, and China has just put in an order for its first two nuclear reactors. We are incessantly told by Commoner and others that it is only the wicked capitalist system that keeps us all from basking in low-priced solar power. But which of the socialist states is attaining—or even striving for—the solar Nirvana?

Such books as this are possible only in a rich country where a glut of everything masks the system that produces it. How else can one explain so ignorant if well-meaning an attack on the most productive system in the world and a proposal to replace it with one that has proven itself irrefragably hostile to freedom and plenty alike?

Still, Commoner has been rather put in the shade by Amory Lovins, whose concept of "soft energy," although identical to the thermodynamic efficiency advocated by Commoner, has proved more salable.

Soft energy paths, by making obsolete much of our hardware, would force an immense conversion cost on us, paid as much in freedom as in money. Presumably, no one would be allowed to purchase an electric range. Whether or not those unprogressive citizens—forming about half of our households—who now operate electric ranges would be allowed to continue doing so is not clear. It is even less clear what to cook with if not electricity, since natural gas comes under the curse of its non-renewability. Wood, perhaps. The same problem occurs with regard to clothes-drying. Here, of course, the outdoor clothesline, operated by a servant—or, in more progressive households, by a wife—is the soft technology of choice.

Lovins argues his unpleasant thesis with deceptive wit, charm, elegance, and clarity. He reminds one of Lowell's description of Poe. But Lovins displays a much lower ratio of genius to sheer fudge.

He severely judges nuclear fission on the basis of what has already been accomplished, but when he discusses the future of fuel cells, he cheerily says that they "can *in principle* be mass-

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produced in simple modules with short lead times, can readily follow 25 to 100 per cent loads, . . . and can use cleanly a rapidly expanding range of fluid fuels." Now, *in principle*, breeder reactors, using existing stocks of depleted uranium, can run essentially without fuel for several centuries, and can be made utterly safe. There is, moreover, a fusion reactor design that *in principle* leaves no radioactive residue and produces electricity without mechanical generators. Lovins would cry foul if anyone presented this process as a reasonable picture of what may be accomplished in the foreseeable future, for immense engineering problems—greater than for "conventional" fusion—remain to be solved and may prove insoluble.

Lovins' book is plagued by inaccuracy, uncalled-for generosity, and misleading treatments of his subjects. He misdescribes a wind generator at Tvind, in Denmark, calling it "two-bladed" (it has three blades) and saying that it "costs" $350,000. When I was at Tvind in late 1978, I was assured by its owners that it cost $1 million, and, at that, the labor costs in that figure are based on subsistence wages for the communard builders. And a year after the publication of Lovins' book, in which he speaks of the Tvind windmill as an accomplished fact, it is still undergoing tests, has not been connected to the grid, has never been operated at full power, and is a subject of considerable controversy in Denmark, especially over its safety.

This is not the only example of Lovins' substitution of promise for reality. Discussing fluidized-bed combusters (devices for efficient burning of fuel) he describes the virtues of a "currently available" system using them. These are such that one wonders why the system is not bought by utilities in the hundreds. One reason is that the price is low compared only to processes of coal gasification that Lovins estimates would be competitive if the price of oil rose to $40 a barrel.

Later in his discussion, Lovins describes this same system as follows: "a detailed design study by Stal-Laval Turbin AB . . . has been developed to the point of cost estimates on which a commercial tender could be based."

That is, the system described as "currently available" from Sweden is still in the design-study stage of development. It would be substantially more honest (although still quite false) to call the French Super-Phénix breeder reactor, now under construction, "currently available."

Lovins is at his most fantastic in his essay "Rebottling the Nuclear Genie," where he is at great pains to argue that a country which acquires light-water power reactors can use them to make bombs. Let us for the sake of argument ignore the fact that power reactors are an unnecessarily cumbersome way to make bombs, less satisfactory than research reactors. No country has used a power reactor to make a bomb; it is always bombs before power. But we *cannot* ignore the fact that a substantial number of countries already have operating nuclear power reactors and that if these are a credible means of producing bombs there is not much we can do about it except to offer carefully safeguarded fuel and waste disposal services at unbeatable prices. The only other plausible nonproliferation policy toward such countries is to make war on them.

Lovins believes that a U.S. policy composed about equally of embargo and finger-shaking will actually convince the rest of the world to forgo the nuclear option. He believes, apparently, that the Soviet Union will renounce its program of reactor export. Those who say that the French will sell their own reactors, including breeders, to other countries, Lovins calls ignorant of the realities of French nuclear policy. In point of fact, French policy has since 1958 undeviatingly and intelligently pursued the national self-interest. France sells weapons where it wishes in defiance of U.S. desires, tests nuclear weapons in the atmosphere, and stays out of NATO. It is preposterous to assert that a country with no oil and little coal, a strong desire for autonomy, and a vigorous breeder program can be kept from commercializing breeders by our saying, "Now, you stop."

In fact, Lovins proposes that the U.S. become the world's nuclear policeman, dictating energy policy for the rest of the earth's billions. We almost certainly do not have the power to do this. To attempt it would make us the most hated nation in the world. It is a melancholy thought that the author of this book is reported to be taken seriously in the White House.

RALPH NADER's book—he has a coauthor named John Abbotts, but Nader's trademark is on the book—is a thoroughgoing compendium of the case against nuclear power. A few selections from it demonstrate that Nader lacks at least one of the two qualities that would be necessary to justify his present reputation: competence and honesty.

The most pervasive of the book's problems is a grand evasion: the pretension that only nuclear power has risks, and that it can therefore be held to a standard of zero danger. Nader appears ignorant that coal mining is a dangerous occupation; and that coal-fired plants emit hostile chemicals, including more radiation than nuclear plants; and that dam disasters have killed several thousand people in the past two decades. Yet he suggests to the public that the alternatives to nuclear power—of which only coal is viable at present—are without risk.

The book is fraught with remarks that suggest foolery or knavery. In a discussion of the health hazards of energy sources, Nader concedes that fewer uranium miners than coal miners are killed, but claims this is because nuclear power provides less energy than coal. As it happens, the power production from each fuel and the death rates from extracting each of them are well known. The calculation of the number of miners killed per unit of electricity is a simple one. Nader, having brought the issue up, ought to have made and printed the calculation; but although he has not done so, others have: nuclear power is less hostile to miners by a ratio of almost 100 to 1. Counting merely mining accidents, and ignoring not only lung cancer in uranium miners but the far more prevalent black lung in coal miners, a billion megawatt hours of electricity produced from uranium kills two uranium miners. A billion megawatt hours from coal kills 189 coal miners. The discrepancy is a measure of Ralph Nader's credibility.

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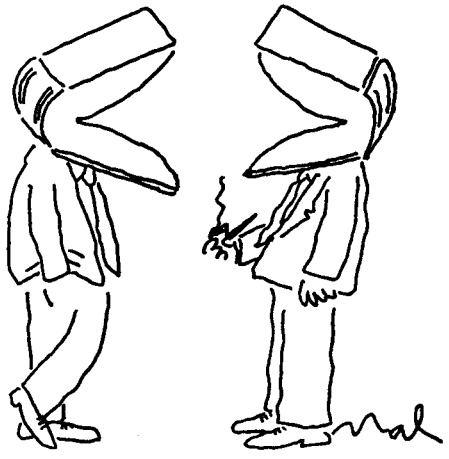
His treatment of breeder reactors illustrates extraordinary tendentiousness. In the ten pages devoted to the topic, Nader cites *none* of the advantages claimed for the breeder, even to refute them. He does not, for example, note that a breeder can be operated on depleted uranium enrichment tails already above ground and useless except as breeder fuel. Still worse, like Commoner, he ignores the successful British and French breeder programs. But he does somehow remember the troubled Soviet breeder program.

Equally tendentious is his analysis of waste disposal. He mentions the vitrification process—converting waste into glass—only *en passant*, quoting an ERDA press release saying that a particular form of vitrification is unsuited to military wastes. Using this candid admission as evidence that ERDA cannot manage "its own"—that is, the Department of Defense's—wastes, he does not mention that the problem has been corrected. He omits any reference to the 13 years of European development of vitrification or to the French plant at Marcoule, nearing completion as he published in 1977, and commissioned last summer.

The word for this book—which employs the tactics usually attributed to the least responsible denizens of Madison Avenue—is *scandalous*. And indeed, that is the word for most of the anti-nuclear movement. If the United States forswears the nuclear option—an outcome that through deliberation or inadvertence now seems likely—more will be at risk than the profit margins of wicked corporations. The lives of miners are at stake. So is the country's supply of reliable electric power. (We are constantly told that nuclear power is highly unreliable. We are not told how, then, heavily nuclear New England gets through winters when the Ohio Valley is plagued by threats of blackout.)



The disturbing fact is that the anti-nuclear movement appears to be largely the plaything of a bored and affluent New Class that has never had to worry about where the energy comes from. Regrettably, the catastrophes that will bring these people to their senses will also afflict everyone else. □

Nuclear Power: Issues and Choices
By the Ford Foundation
Ballinger (1977), 448 pp., $17.50
(paperback, $7.95)

The Silent Bomb
By Peter Faulkner
Vintage/Friends of the Earth
(1977), 384 pp., $3.95

NO EXIT

WILLIAM TUCKER

Perhaps the greatest irony of the debate over nuclear power is that the conservative utilities industry probably never would have been coaxed into spending the last ten years developing atomic energy if it hadn't been for all the prodding from the environmental movement.

Environmentalism, you may remember, began by focusing on the scenic damage being done by hydroelectric plants, and on the growing problem of air pollution in the cities. Nuclear energy, said the environmentalists, was the obvious answer to both these difficulties: it was only the unimaginative leadership of the utilities industry which prevented it from being put into effect. Next to the Atomic Energy Commission, the Sierra Club was probably the foremost advocate of nuclear power during the 1960s, and practically every lawsuit brought against a new dam or a coal-burning generator during that era listed an atomic-energy plant as the reasonable alternative.

How did it happen that the biggest advocates of nuclear power have become its most ravening opponents? Environmentalists will answer this question by saying that the truly "malignant" aspects of nuclear power "weren't apparent" in the 1960s: it was all a big mistake on their part not to see them, but, after all, it wasn't their worry—it was up to the technicians to work out the specific problems. Now, it would be possible to make some rather cogent criticisms of this argument, but perhaps it is best just to point out that environmentalists are, in fact, precisely people who *don't have to worry* about whether the seemingly benign "alternative" forms of energy hailed today as the solution to environmental problems turn out 15 years later to be mere mirages. Their responsibility in these matters is zero, and when the day comes when there is no power, or when prices skyrocket because the wrong decisions have been made, they will simply blame it all on the power companies. The public, which resents the utilities for a whole different set of reasons, will be only too happy to go along with this verdict.

As the Ford Foundation's 1977 report *Nuclear Power: Issues and Choices* correctly points out, the current issue with regard to nuclear power is whether electricity, which takes up 25 per cent of the nation's fuel budget, is going to be generated in the future from nuclear power or coal. Atomic energy is not going to replace gasoline in cars, or natural gas in home heating (even with nuclear power, electricity will probably remain more expensive; solar energy may play a role here). But either coal or nuclear power *is* going to be replacing oil and gas as the major source of electrical generation. The decontrol of natural gas prices will soon eliminate the extraordinarily wasteful practice of burning natural gas to produce electricity (which has enabled California and other states to avoid until now the choice between nuclear power and more air pollution). The recent 15 per cent oil-price increase by OPEC is only a blunt punctuation mark to the statement that the days of burning oil to produce electricity are about over.

Coal or nuclear energy, take your choice. It's that simple.

The choice of the Ford Foundation is nuclear energy, with one small hedge. The Foundation's Nuclear Energy Policy Study Group, a committee made up of experts from both sides of the question, has recommended that the

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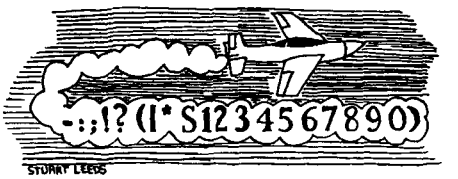
nation forgo, for the time being, the introduction of the breeder reactor and the "plutonium economy." The study group isn't wildly alarmed by the talk of terrorist groups, but it does think that the risks of handling plutonium in large quantities and the danger of weapons proliferation to small countries should weigh against the breeder system.

On almost every other count, however, the study group sees coal as far more of a threat to health, safety, and the environment. Coal is dangerous and difficult to manage at almost every step of the process, and leaves a much greater trail of destruction behind it. Even if once a century the worst possible scenario occurred—a nuclear "melt-down" which released radioactive debris killing perhaps 10,000 people outright and causing another 15,000 to die eventually of cancer—the casualties in a nuclear accident would not match the number of people killed at railroad crossings by trains making coal shipments over the same period of time. The health problems caused by coal mining are now responsible for almost 45 per cent of the disability payments made in this country. Coal is by far the worst producer of air pollution. In addition, most scientists are now ready to acknowledge that the "greenhouse effect"—the dangerous warming of the earth's climate from too much carbon dioxide in the atmosphere—may be a block to a permanent coal economy.

NOT TO BE discouraged, however, the anti-nuclear movement continues to parade the "worst-case" arguments, which quickly degenerate into a stream of irrationalities. Thus, in *The Silent Bomb*, which is probably only typical of the anti-nuclear books now on the market, we read that "according to published research papers, there is no 'safe' level of radiation exposure." This is indeed disturbing, since we are constantly being bathed in a sea of low-level natural background radiation from rocks, trees, our own bones, and cosmic rays. Yet without any qualification whatsoever, *The Silent Bomb* goes on to tell us that "a variety of anomalies, many verging on the monstrous, are possible as a result of radioactive damage to the genes. Gigantism, dwarfism, albinism, club foot, harelip, cleft palate, Siamese twins, Janus monsters (two faces on a



single head and body), phocomelia (rudimentary limbs), sirenomelus (legs fused, with no separate feet), hydrocephalus (grotesquely distended head), and hermaphroditism (physical bisexuality) may be induced by radioactive bombardment of reproductive cells."

One critic of environmentalism recently tried to put all this in perspective by noting that the increase in radiation exposure that a person would experience in moving next to a nuclear plant is about half what he would experience in moving from the low-radioactive sandy shores of Brooklyn to the higher-radioactive granite rocks of Manhattan. No wonder Manhattan has such a reputation for social oddities!

The Ford Foundation report dispels several other myths which can be read fresh off the pages of *The Silent Bomb*. After criticizing the utility companies for making erroneous "straight-line" projections of electrical demand into the 1980s, one author in *The Silent Bomb* (a loosely edited collection) tells us that because uranium cost $3 a pound in 1965 and $40 a pound in 1975 (when the price was fixed by a cartel of non-U.S. suppliers), it will probably cost $100 ten years from now. Therefore it's too expensive and we can't afford it. QED.

The Ford Foundation report points out, quite reasonably, that at $40 a pound, and with already existing technology, it will soon be economical to go back and mine all the highly radioactive "tailings" of previous extraction efforts for more uranium. There will be plenty of nuclear fuel available at $40 a pound for years to come, and the myth of the coming "uranium shortage" is just another scare story from people who don't understand economics.

On the other hand, the Ford Foundation group is willing to go half-way by saying that the U.S. could now postpone development of the plutonium-fueled "breeder" reactor without suffering significant economic penalty. They suggest that this will avoid a "plutonium economy" with its threats of hijacking and terrorism, plus the problem of handling the highly radioactive materials and the proliferation of small bombs to other countries. The committee, I have the feeling, is hoping that if the country would only throw a few aspects of nuclear power overboard, the environmentalists might be willing to compromise too. Although the decision to delay the Clinch River Breeder Reactor has already been made by the Ford and Carter Administrations, I think one must realize that this technique of throwing a few scraps to the environmentalists is not likely to work.

Note that nuclear "wastes" were never intended to be treated as wastes in the first place. The spent fuel rods were scheduled to be stored until their gradual accumulation made it economically feasible to reprocess them for extraction of the remaining highly fissionable uranium isotopes, plus the newly created plutonium. The plutonium would then go into breeder reactors where the fuel pellets would be surrounded by a blanket of low-fissionable U-238, which, when bombarded by the fission products of plutonium, would produce *more* plutonium. Four units of plutonium would be produced for every three that went into the process, thus creating something very close to a perpetual motion machine. Nearly all the "wastes" in the system would thus be recycled.

WITH THE first indications that the plutonium economy might be about to start operating, however, nuclear-power opponents began telling their horror stories about "terrorism and hijacking." Early difficulties with the safe handling of plutonium have added to the problem, and both the Ford Foundation group and the Federal Government now seem willing to abandon the effort.

And once the "back end" of the fuel cycle had unraveled, it became a simple matter for the environmentalists to unwind it all the way back to the beginning. If spent fuel rods can no longer be reprocessed, then they *do* become "wastes" in the normal sense, and must be discarded. This gives environmentalists the opportunity to run around the country, popping up in front of the Department of Energy in every locality and stirring up public fears about permanent storage of these wastes, even in the safest and most remote locations. In

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these circumstances, waste disposal really does become a problem, and it has been quickly tied to reactor licensing. In July 1976, the U.S. Court of Appeals in Washington ruled in favor of the Natural Resources Defense Council (NRDC) and stated that a permanent solution to the problem of waste disposal must be developed before any more reactors can be licensed. Thus, even as Ivy League college students have been confronting construction workers over Seabrook, the issue of the future of nuclear energy in this country has been pretty much decided. There isn't likely to be any more nuclear power for quite some time, if ever.

DOES THIS mean that environmentalists are willing to settle for coal instead? Don't bet on it. While putting nuclear power in temporary cold storage, the NRDC has simultaneously been suing the Department of the Interior over its environmental impact statements on leasing new coal fields in the West. Interior lost (with an ex-NRDC attorney helping to defend it in court) and in order to speed the resolution of the case has made a bargain wherein it will completely rewrite its impact statements in exchange for leasing small coal areas *contingent upon NRDC approval*. In other words, the country's major coal resources are now hostage to an environmental group, with no guarantee that the NRDC will even approve the new impact statements when they are finally completed around 1981. Meanwhile, industry, which is going to be doing the actual mining, has not even been consulted.

Coal or nuclear, that's the issue. Or is it? I don't quite think so, and it is precisely here that the weakness of the Ford Foundation report begins to emerge. All through the grim four hundred pages of dry technological language I had the uneasy feeling that something was being overlooked. The report assumes, in the civilized manner adopted by most committees, that the other side is willing to play the game by the same rules. The "choice" between nuclear and coal will be determined by "market forces," says the report, with safety, health, and environmental considerations all being translated into economic terms. After everything has been measured, it will simply depend on which way the balance tips. What the Nuclear Energy Policy Study Group doesn't seem to consider is the possibility that *neither* technology will be brought to the marketplace, and that both will be ground to a halt by the web of regulatory entanglement that is the heart and soul of environmentalism.

Somehow I don't think the reasonable, hopeful men of the Ford Foundation have entirely grasped what environmentalism is all about. Environmentalism is not an attempt to consider "issues and choices," but a concerted effort to *eliminate* the choices one by one until none remains. Environmentalism, in fact, is something like the death-wish of an affluent, educated elite that has already achieved all the material success it could ever want, and hopes now to slip back into a blissful state of euphoria, dragging the whole country along with it. It is this possibility that the Ford Foundation's polite and earnest proponents of either-one-form-of-energy-or-the-other have failed to address. It seems fair to say that nothing is going to break on the energy front until someone does address it. □

Nuclear Theft: Risks and Safeguards
By Mason Willrich and Theodore B. Taylor
Ballinger (1974), 272 pp., $20 (paperback, $9.95)

The Curve of Binding Energy
By John McPhee
Farrar (1974), 224 pp., $7.95; Ballantine paperback (1976), $1.95

TERROR AND ANXIETY

B. BRUCE-BRIGGS

One of the many burdens laid on the nuclear power industry is the charge that it might become a party to the ultimate terrorism. Stolen nuclear fuels or wastes could be converted to atomic weapons by revolutionaries or criminals who would threaten the very fabric of civilization, or at least force draconic security measures which would destroy anything resembling a free society. The two books which have developed and popularized this thesis, Willrich and Taylor's *Nuclear Theft* and McPhee's *The Curve of Binding Energy*, are now a few years old but remain the basic texts on the risks of nuclear theft.

The first thing one notices about *Nuclear Theft* is its sponsorship by the Ford Foundation, which gives immediate cause for alarm. Worse, the study was a product of the FF Energy Policy Project, whose summary report, *A Time to Choose* (not to be confused with *Nuclear Power: Issues and Choices*), was widely ballyhooed; was savaged by oil companies, social democrats, and economists; was disavowed by FF executives (according to a credible account by Lewis H. Lapham of *Harper's*) yet jubilated in a later FF annual report; was fed to James Earl Carter, who made it the basis of his anti-energy policy; and finally led to the director of the Energy Policy Project, S. David Freeman, becoming power commissar of the Tennessee Valley.

The Curve of Binding Energy was originally written for *The New Yorker*, which was then in its radical chic phase and which continues to reflect its audience's concern for the erosion of *its* quality of life caused by the mass prosperity that has been engendered by the economic growth fueled by abundant energy. McPhee's name on the title page is irrelevant because the text "was developed with the editorial counsel of William Shawn and Robert Bingham," and perfectly follows the successful *New Yorker* formula of making material palatable to its readers by cross-cutting between the serious and the frivolous and between the present and the past, laying on heaps of irrelevancies (including, always, the eye color of the principal figures), and, most important, clear and literate prose and scrupulous attention to detail. (This is no myth—this reviewer was once telephoned by *The New Yorker* and asked, "Are you American?" He replied, "Very"; later read an article which attributed a quotation from a book he had co-authored to "two Americans"; and was most impressed.)

Another *New Yorker* convention is to personalize issues by focusing on one man—in this case Theodore Taylor, the co-author of the Ford Foundation study and the person most responsible for raising the nuclear theft issue. Socially, Taylor is an exemplary *New Yorker* character—of old Yankee missionary

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stock, Exeter, Cal Tech, naval officer in WWII, married to a librarian, graduate school at Berkeley. But he flunked his comps, needed a job in physics, and went to Los Alamos as an atomic bomb designer. He now regrets that transgression, but like all repentants, his relation of past sins is more interesting than the beatitudes of salvation.

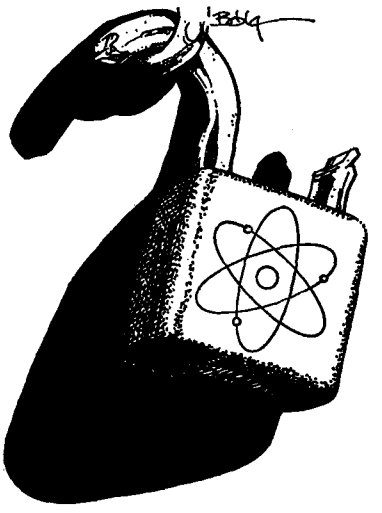
Later he worked on the Orion nuclear rocket project until it was scrapped by the 1963 Nuclear Test Ban Treaty, briefly held a Pentagon job, then founded a small research company that survived on foundation grants and government research contracts. He is now a part-time professor at Princeton.

Taylor also exemplifies the political history of the *New Yorker* audience—staunch patriot in WWII, genteel leftist in graduate school in the late Forties, hard-nosed cold warrior in the Fifties, then a peacenik in the Sixties ("If the Russians bombed New York, I would not bomb Moscow"), then a devotee of Oriental religion, and now active in "environmental studies."

WILLRICH, his co-author, is a former SAC officer who became a professor of international law. The *New Yorker* piece was initiated in a tennis game he had with McPhee. No doubt it is unfair to disregard Willrich's contributions to the Ford Foundation study, but the nuclear theft issue is almost completely associated with Ted Taylor.

Like most plausible ideas, Taylor's is very simple: it is "relatively easy" to make an atomic bomb. The tools and technology you would need are readily available. The only hard part is acquiring the key ingredients, "weapons-grade" uranium-235 or plutonium, and they will become more accessible as more nuclear power plants are built. "Without effective safeguards to prevent nuclear theft, the development of nuclear power will create substantial risks to the security and safety of the American people and people generally." Now we see why the Ford Foundation and *The New Yorker* are interested.

According to Taylor, "The U.S. system of safeguards is incomplete at this time." [See p. 151.] These two books contain much anecdotal evidence of unimpressive security in the handling of fuel and wastes. Doubtless this remark will stimulate a barrage of infuriated mail from the nuclear industry—but we



may grant that their security is lax: because *all* American security is slack, because few Americans can take any threat seriously, and because America has nearly abandoned the traditional practice of imposing sanctions against people who break important rules. When convicted murderers are released in five years, what can be done to a guard who falls asleep while on duty, let alone to an executive who fails to implement security regulations properly?

For several years this reviewer lived half a mile from a nuclear power plant. Many of his neighbors worked in that plant, and would tell chilling tales of the inadequacies of the safety and security precautions. Part of this must be discounted as reflecting the working man's normal resentment of the pretensions of his bosses, but they did not invent the stories. But neither did they move away; unlike sedentary bureaucrats, working people know that risk is inherent in life.

It seems indisputable that a gang of serious terrorists or criminals could knock over a nuclear power or fuel-processing facility and obtain fissionable materials. But what could they do with them? According to Taylor, atomic explosives are easy to make, and the bulk of the two books is devoted to this frightening thesis. Fortunately, Taylor's own development of the idea makes us rest easier.

The simple kind of bomb to build is the gun type, where two chunks of U-235 are thrown together to create a critical mass, fission, and an explosion. The Hiroshima bomb was of this design, and it was dropped without testing, so sure was the Manhattan Project that it would work. Fortunately, U-235 is present in nuclear fuel at far below explosive concentration, and bringing it up to weapons-grade quality is almost impossible without the elaborate, expensive, and complex gaseous diffusion process, which quite properly remains classified and a government monopoly. Conversely, plutonium is relatively easy to extract from reactor wastes, but can only be exploded by an implosion device which is very difficult to manufacture, requiring the talents of the nuclear physicist, the high-explosives expert, and the skilled machinist. Furthermore, plutonium is a dangerous poison, and anyone handling it without elaborate equipment is taking horrible risks.

Taylor can make a bomb in a basement workshop, but he is a brilliant bomb-maker, and he suffers from one of the stupidities of smart people: while nasty smart people think almost everyone else is a boob, nice smart people, like Taylor, assume almost everyone must be at least one-tenth as smart as themselves. Miss Chris Evert is very smart at tennis, and probably finds it inconceivable that this reviewer is incapable of even getting the ball over the net. In any event, why should a terrorist fool with atomic devices, which are easily detected through radiation, when he could kill or threaten multitudes with means more readily at hand—such as, to take the most obvious method, poisoning water supplies?

BUT THERE is a more fundamental fallacy in the nuclear terrorism thesis. Taylor is annoyed that money is protected better than plutonium; sure, because $ are more useful to more people than Pu. But think of the old comic books with highly organized gangs of ruthless criminals knocking off armored cars with cannon; until 1968, anti-tank guns could be mail-ordered, yet armored cars were untouched. Almost by definition, social deviants are not simultaneously ruthless, brilliant, and well-organized. Taylor has absorbed the worst-case thinking that corrupted U.S. strategic thought in the 1950s. In fact, our worst case is the other side's best case; and imperfect men lack optimum proficiency. Capability is not to be confused with competence.

But the most important objection is summed up in an Israeli's explanation of the miserable performance of the

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Arab terrorists: "The competent Palestinians have good jobs in Kuwait; PLO is the dregs." Doubtless many of this magazine's readers had nervous conversations in the late 1960s about how easily terrorists could inflict grave damage on our economy. But you who know what can be done and how to do it, do not become terrorists. Terrorism is for losers.

The best recent terrorists, the Deltas of the French *Organisation Armée Secrète*, were army officers and non-coms —selected, trained, and disciplined men. As Lewis A. Dunn of the Hudson Institute has emphasized, the worst threat to nuclear materials is from commando units or intelligence agents of foreign governments. (A state friendly to the U.S. is widely believed to have been hijacking already.) Oddly, this menace is not discussed by Willrich and Taylor; nor does either book mention that Taylor's research company was set up to sell safeguard systems and hardware to the nuclear power industry. It might be that Taylor's unsold industrial security products would be useless against foreign raiders.

To this reviewer, the queerest aspect of the nuclear safeguards issue is that information on how to build nuclear bombs is available to the general public, declassified by the Kennedy Administration in response to agitation by liberal scientists annoyed by the security regulations. Incredibly, Willrich and Taylor wanted to publish an extensive list of publications useful to the private fission-bomb designer, but were dissuaded by the Ford Foundation's reviewers. Yet the *New Yorker* book offers some of this information, together with Taylor's ruminations on how an amateur bomb-maker might go about his business. In the face of such astonishing irresponsibility, the first safeguard should be the reclassification of any material dealing with atomic munitions.

While some skepticism has been expressed regarding its motives, conscious or unconscious, in fact the Ford Foundation has performed a public service by supporting this study. Although the theft of nuclear materials for private bomb manufacture is highly unlikely, low probability is not zero, and responsible men should take reasonable precautions to avert potential tragedy. While the nuclear industry labors under many unnecessary and unfair burdens, a small load of safeguards it must bear. Taylor points out that this obligation may last only a generation, because fusion power will probably make fission obsolete and there is no "relatively easy" way to make a thermonuclear bomb in the basement—at least not yet; and should (God forbid) one be learned, we may hope it will be given the toughest security classification, and that the Ford Foundation will sponsor a study of the most prolonged and exquisitely painful means of liquidating anyone who threatens to broadcast it. □

Mushroom: The Story of the A-Bomb Kid
By John Aristotle Phillips and David Michaelis
Morrow (1978), 287 pp., $8.95

THIS SIDE OF HONESTY

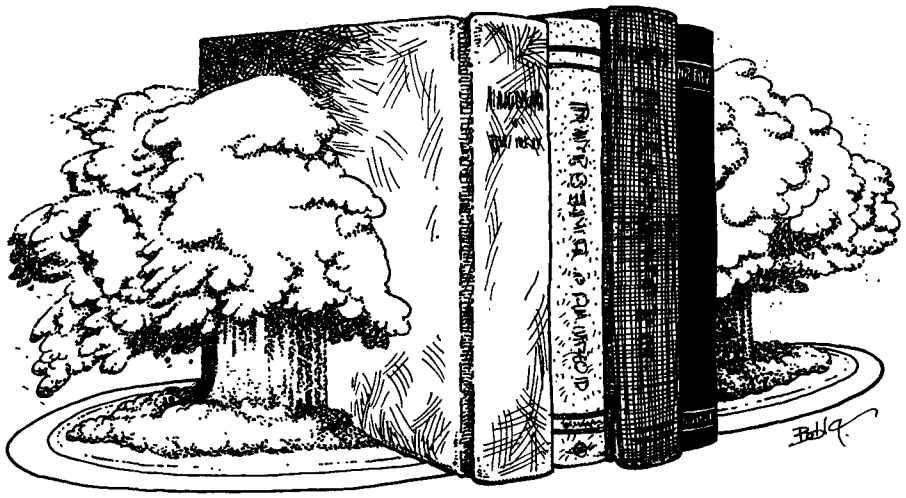
ALAN L. MILLER

"Once upon a mushroom, I was whoopeed."

Thus begins the saga of a Princeton undergraduate who "designed" an atomic bomb in 1976 to fulfill the requirement for a class project. John Phillips' improbable endeavor was meant as a warning that if an ordinary college student might create such a weapon, so too could terrorists intent upon wreaking havoc upon a nation that is lax in regulating its nuclear materials. In the intervening years, Phillips has parlayed his find into a forthcoming television movie and this book, ghosted by his college roomie. As the above sample of their bizarre prose suggests, the authors favor the style of the absurd, which causes their flippant account to sound less like a book than a whoopee cushion.

It all began with young Johnny wanting to see "the curve of the earth," while his stodgy New Haven elementary-school teachers keep insisting that he learn the mundane basics. Not to worry. Mom assures her boy that such arbitrary restrictions will not be able to thwart his burning ambition to do anything he wants. After distinguishing himself as an apprentice troublemaker in high school, John makes the natural transition to Berkeley in search of "The Movement." But, alas, the war and Richard Nixon are no more, and the California campus is just . . . collegiate. Swallowing his disappointment and sensing that his brain was "slowly turning to oatmeal," Phillips heads back East. But to what? Harvard is so pretentious, Yale too close to home. Princeton seems worth a go this season.

Here our Diogenes is once more beset by preppies and phonies. A disillusioned Phillips watches himself bounding like a pinball from one absurdity to another in search of MEANING. So it is that he memorizes the law of probabilities for games of chance and breaks the bank at the Cottage Club casino, where he meets kindred spirit Michaelis at the blackjack table. The two become comrades and resolve to write the script for the annual musical revue. It is not to be. Their unorthodox creation is rejected and Phillips discovers that stodginess is a continuum, as Princeton places him



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on probation for neglecting his academic duties. Our hero philosophizes: "The screaming rhubarbs definitely have me by the balls."

Attending a class on arms control and disarmament, Phillips is captivated by a vivid description of nuclear devastation. During a subsequent scenario that concerns plutonium pirated by terrorists who are planning nuclear blackmail, he is challenged by the conclusion that a homemade bomb is virtually impossible. Recalling Mom's admonition that nothing is beyond his grasp, Phillips becomes a man possessed.

CONFINED to his room, he devours John McPhee's *The Curve of Binding Energy* and vows to show the world that a nuke can indeed be constructed by a scruffy undergrad, "the screaming rhubarbs" notwithstanding. Forsaking food, sleep—even Fort Lauderdale at spring break—Phillips pursues his quest with unrelenting fervor. Collecting all available data from the National Technical Information Service in Washington, he slowly pieces together the elusive puzzle under the skeptical guidance of a supervising professor. When Phillips senses he is close to success, he gambles a call to the explosives division of Du Pont and bluffs his way toward the missing link that assures his solution. Attacking the "Capitalist Pig" (his typewriter) with feverish abandon, Phillips completes the 34-page manuscript and rushes the paper to the stodgy physics department secretary who plays "Lady Starched Bottom" to his "Knight of the Prickly Chin." By now everyone thinks him crazy but just as he considers "going home to Jerome" (insanity), Phillips learns that his paper has been awarded an A and consigned to the government for classification. Invited to a NASA Space Colonies Summer Project in California, he attends but hears a different drummer, and proves it by preferring Walter Cronkite to *Star Trek*, the popular evening TV choice of the conferees.

Returning to Princeton that fall Phillips and Michaelis launch a highly successful pizza delivery service. Phillips then becomes the Tiger Mascot and hopes to resume a life of relative anonymity, but the Fates of Whoopee have other plans. Phillips is contacted by several newspapers and becomes an instant celebrity. The A-Bomb Kid is hounded

by international media intent upon exploiting his MEANING. He is wont to snort: "Reading *People* magazine is like masturbating. Everybody does it but no one wants to admit it." Yet he consents to their doing an article on him. Déclassé yes, but certain sacrifices must be made to enlighten the masses.

Foreign agents chase him. Campus security gives way to an FBI agent who resembles Don Rickles. Senator Proxmire refers to Phillips' work in a ringing Senate oration. ABC and CBS profile "The Kid" and invite him onto the talk show circuit to inveigh against Brown's Ferry, nuclear waste, and the devil plutonium. Contacted by numerous publishers, Phillips and Michaelis consent, after retaining a lawyer, to write a book. Next comes Hollywood bearing gifts. Phillips demands both script approval *and* the lead. "Impossible!" shrieks the wily producer. "Don't tell me what's possible and what's not," the prodigy snaps; "I designed an atomic bomb." No fool Phillips: hardballing the moguls, he lands the deal and a star is born. Or proliferated. Check your TV listings for time and hype. □

The GIMLET EYE

BLOWN OUT OF PROPORTION

D. KEITH MANO

I believe in the Resurrection. Allen Ginsberg, his mind trepanned out—a testimonial to thirty years of hash-breathing—has come back to life. Not for poems: to bonk on a woodblock and yawp his scum ballads. Liberace's brother was more gifted musically. Looking, without his beard, like a glabrous iguana: a nice trick, since iguanas are by nature glabrous anyway. And David Dellinger, reading from his four-shrug autobiography. David wants jail again so much: it was his single distinction, that someone should bother to incarcerate him (also, he ran across a secret homosexual Dellinger in there). Both men are on hand to medicine-show for the NYU Anti-Nuclear Student League. While uptown, at Free Space Alternative—a tenement on Lafayette Street that suppurates silverfish, where from 1970 to 1974 I covered six or seven antiwar, anti-Nixon, anti-CIA-SST-RSVP symposia—the New York SHAD Alliance is screening anti-nuclear film footage. An alumnum (to avoid sexist terms) reunion. I can recognize at least six characters in search of some issue. They haven't changed underwear since Cambodia.

By now, of course, Ban the Bomb is a dud. After all, since Hiroshima 33 years ago, nothing but Chanel #5 has been atomized. Nonetheless, the peaceful use of nuclear power is a nifty and natural leftist *bête rouge*. It has three essential issue-requisites. 1) About 47 people in His whole creation can understand the physics involved: general refutation is near-impossible. 2) With nuclear power you trade in astronomic infinitesimalities—hell, even a radical has trouble exaggerating enough. ("The smallest doses of radiation . . . increase the possibility of genetic mutation." "A major nuclear accident would . . . contaminate an area the size of Pennsylvania." Why not Texas; why not let yourself go?) 3) The subject can scare the bejazus out of people. Which means, chiefly, saying cancer, cancer, cancer like a Krishna chant. I have in my reluctant hand this four-color brochure of mutilated Japanese. So loud it could deafen the eye. Done up by folk who'd call any Right to Life pamphlet that pictured thrown-out fetuses a gross and, worse, Catholic melodramatization.

But the slipped disk, for A-energy advocates, is not 1), 2), or even 3). The critical mass is this: that a nuclear generating plant must be built *somewhere*. Both conservative and radical have caught on about America in the last half-decade: a news flash will register only if it might affect Number One: Big Me. Broad idealistic movements are contagious as yawns, and about as mobilizing. Even the great Vietnam protest was largely personal, draft-blown. Most of us might have had it with Richard Nixon by 1974, yet few marched on Washington. Now I favor nuclear energy, but, well, I dunno if I'd like to live neighborly with a pile of radioactive

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pick-up sticks. You can empathize: people in Shoreham or Seabrook get a Why me? Why here? complex. Still, reactors can't be built economically where reindeer and caribou play. And this gives your anti-nuke backed aces in his five stud game. No logical argument favoring nuclear power will entirely reassure a six-month-pregnant woman.

New York, for once, has been the laggard. SHAD Alliance (Sound-Hudson against Atomic Development—oh, how we strain after acronyms) isn't one year old yet. But the recent arithmetic surprised precinct bosses of the New York Left: 6,000 people at Rocky Flats (Colorado), 4,000 at Bangor (Washington), 18,000 at Seabrook. Now they want a cut of this action. The NYU chapter and the citywide chapter (Free Space), though weak organizationally, have set their Norden sights on Shoreham, Long Island (June 2-3). With its huge circumscriptive population, Shoreham should be a major ruckus: and a vitamin B-12 shot for leftist anomie. But the attack remains decentralized: you'd be hard put to gather 18,000 for a protest against nuclear power in general. Plants like Shoreham (90 per cent complete) are wonderfully vulnerable: they can't be moved: they represent a boggling financial investment. And, at ground zero, blue-collar non-activists can turn from stolid U-238 to unstable U-235. Note that the June protest hasn't been planned for Indian Point, New York, an operational facility. People there are phlegmatic: if radiation cancers you, they're already done for, and the dead don't demonstrate much. Even idealism has its triage.

THERE ARE 23 leaflets, fliers, broadsides, magazines throw-rugged around my desk. All start off with an atom-in-the-gonad fright tale re some local nuclear plant. But, though tactics are neighborhood, strategy is national: there will be fall-out on American defense and industry. The text shifts, again and again, to its real objective. For example: *Independent Nuclear Opinion* can say with a straight typeface that "nuclear power epitomizes power concentration, which leads to more centralization and less autonomy. The [get this!] invisible hand of Adam Smith is squeezed into submission by the abuse inherent in centralized power." Such concern for Adam Smith. While, in its next paragraph, *INO* begins rooting for a California *state solar industry* bill. As to defense: leaflet and flier and broadside make the same questionable point: peaceful atomic technology leads to war technology. And then you think, hmm, June 2-3 is an interesting date. By late spring the Senate could well have Carter's dubious SALT agreement to approve or disapprove. Mass rage at Shoreham would certainly contaminate Washington with unacceptable rads of voter fear.

But what this mimeograph spew doesn't much discuss is alternative energy. Because there are no viable short-term alternatives. A day may come when we all wear windmill beanies, with a lampcord running out of each trouser cuff, but before then America will have been unbombed back into the Stone Age.

We have one sure ally, though: OPEC. Come late spring Shoreham gas stations may be pumping $1 per gal. That, at the crabgrass-roots level, may be more influential, certainly more visible, than problematic radiation and disaster movie Nagasakis on Long Island. □

BOOKS IN BRIEF

WE ALMOST LOST DETROIT, *by John C. Fuller (Ballantine, 288 pp., $1.95; paperback).* Fuller, a veteran muckraker, here examines in somewhat uneven prose the star-crossed Enrico Fermi fast breeder reactor, a $130-million investment situated midway between Detroit and Toledo. In operation a mere 378 hours, it showed classic symptoms of mechanical failure; it was scrapped in 1972. Despite the cover's rather hysterical-sounding chatter about a Hiroshima-style big-bang disaster, the book itself employs more measured rhetoric in dissecting the Fermi reactor's immobilizing melt-down and the very far-reaching dangers if the whole sequence of safeguards in a nuclear reactor were ever breached. The memory of the Fermi incident and earlier events at Chalk River, Windscale, and Idaho Falls is a serious hurdle nuclear energy must face in its attempt to gain public confidence; it serves especially to trigger the nagging questions fission advocates must face in every open debate on the subject. DAVID PIETRUSZA

THE HEALTH HAZARDS OF NOT GOING NUCLEAR, *by Petr Beckmann (Golem Press, 194 pp., $10.95; paperback, $5.95).* Remember the TV depiction of a little girl being engulfed by the nuclear holocaust that was sure to follow Barry Goldwater's election in 1964? Such virulent prophecies are rampant again as zealots spread the gospel that nuclear power must be stopped at all costs. That their crusade is costing the U.S. dearly by delaying the advent of an efficient energy source is the burden of this slender volume, which clears the air of those mushroom-shaped clouds. Armed with the impeccable credentials of a scholar and the talents of a rhetorician, Dr. Beckmann does not suffer fools gladly. Accordingly, he dedicates this devastating polemic to "Ralph Nader and all who worship the water he walks on." Beckmann, a professor of electrical engineering, submerges these Naderite advocates beneath a stream of logic demonstrating that nuclear power is far safer than fossil fuels for large-scale energy conversion. To make his point, Beckmann calmly presents data showing, among other things, that atomic reactors are not subject to explosion; that their radiation level is minuscule compared to the radiation levels of such alarming objects as food and the soil; and that Lake Erie is in no danger of boiling over. More, he proves that no other energy source has been so painstakingly monitored to minimize malfunctions; in consequence, the safety record of nuclear plants is excellent. Though this book is in its sixth printing and has been translated into five languages, you will have trouble finding it. The market remains bullish on hysteria.

LEON SPENCER

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Dark Horses

M. STANTON EVANS

A SURVEY OF occasional literature on nuclear power could have no better starting place than Petr Beckmann's *Nuclear Proliferation: How to Blunder into Promoting It* (The Golem Press. Box 1342, Boulder, Colo 80306; $2).

Beckmann—whose seminal *Health Hazards of Not Going Nuclear* was previously noted in "Dark Horses" and is considered elsewhere in this issue [see p. 186]—is an acknowledged master of technical-scientific issues in nuclear discussion and also of invective against the anti-nuclear Luddites. True to this reputation, the present study is both a primer on nuclear basics and a powerful argument in favor of developing nuclear energy in general and fast breeder reactors in particular.

Among the major points affirmed by Beckmann is the fact that the low-grade (3 per cent enriched) uranium used in peaceful nuclear reactors cannot be used for nuclear explosives (which employ uranium 90 per cent enriched). Hence the oft-cited notion of a nuclear blow-up at such a plant is an impossibility. He also torpedoes the idea that plutonium is the "most toxic substance known to man" (it isn't) or that it lends itself to use by terrorists (it doesn't). The main thing plutonium is good for, he says, is to provide an adequate supply of energy for a thousand years—which is why the anti-nuclear Luddites oppose it.

Beckmann's concluding point is that the emerging U.S. policy of forswearing nuclear power and trying to discourage its use by others is completely futile, inasmuch as 45 nations have already pressed ahead with nuclear development (including plutonium in several cases) are generally dependent on it for adequate fuel supplies, and are not about to renounce it simply because we ask them to. Indeed, to the extent that we deny them access to nuclear technology, they may be goaded into developing their own as a matter of survival. Some may even be tempted to go the weapons route as a method of entering the nuclear club, since weapons are easier to develop than peaceful power.

The relative risks involved in development of the peaceful atom are discussed in a lively round-robin debate entitled *Is Nuclear Power Safe?* (American Enterprise Institute, 1150 Seventeenth St. N.W., Washington, D.C. 20036; $2). The discussants include Ralph Nader and Daniel Ford on the anti-nuclear side, Craig Hosmer and Ralph Lapp as nuclear advocates, and former Sierra Club President Lawrence Moss speaking from somewhere in the middle, though tending toward the nuclear option.

LAPP, who used to be a hero among the liberals, does a pretty good job here of taking Nader to task, zapping Ford's "Union of Concerned Scientists" for its lack of expertise, and spelling out the efficiencies of nuclear power compared to other energy sources. Former Representative Hosmer also makes some excellent points in favor of nuclear power, while Moss draws a telling contrast on environmental grounds between nuclear power and coal. The exchanges between Nader, Ford, and the nuclear proponents serve to lay out the basic issues clearly.

Finally, the costs and benefits involved in a specific nuclear project are discussed by energy specialist Milton R. Copulos [author of "The Price of Power," p. 156] in *Confrontation at Seabrook* (Heritage Foundation, 513 C St. N.E., Washington, D.C. 20002; $2). This is a very good brief discussion of the issues surrounding the nuclear power project at Seabrook, N.H., which has been the topic of intense dispute for the past three years. Copulos explains the nature of the project, what it means to the energy economy of New Hampshire, and the elaborate steps that have been taken to ensure the safety and environmental soundness of the project. This discussion confirms the Beckmann verdict—that the foes of nuclear power are really seeking the deindustrialization of America. □

1978
National Review
INDEX

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Personal

(NR extends maximum freedom in this column, but NR's maximum freedom may be another man's straitjacket. NR reserves the right to reject any copy deemed unsuitable. —Pub.)

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Solution to Last Issue's Trans-O-Gram

[Jean] BURDEN:

Thoughtless Dog Owners

The chief bane of suburban dwellers is the barking dog, left outside to howl its loneliness all day or all night while the owner goes his or her own way, blessedly out of earshot. The dog gets all the blame, while it is the thoughtless owner, of course, who, should be taken to task.

(Title supplied; actual title *Are You a Responsible Pet Owner?*)

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GRAY, MILEY & BRUMLIK

(Continued from page 162)

expected to "break even"—to produce as much energy through fusion as they consumed in heating the "plasma"—by the early 1980s.

How much will it cost us if present trends continue, and the fusion era is delayed?

The Department of Energy has targeted the year 2025 for the employment of the first commercial fusion reactors. The United States is importing $1 billion worth of oil each and every week of the year. By 2025 we will have expended well over a trillion dollars on oil imports. (This is more, by way of comparison, than the total value of all securities currently listed on the New York Stock Exchange.) Clearly, the date selected by the Department of Energy is far too late.

Capitalized Costs

America must not expend hundreds of billions of dollars on foreign oil while it has cheap and plentiful fusion fuel at hand. The time has come to stop flirting with fusion, and to demand of our leaders a total national commitment to get us back on the track toward inexpensive energy. We must not accept the current schedule; we must plan instead to have a fusion economy in place by the year 2000. We cannot afford to have foreigners standing in line to buy American industries and securities with weakened dollars (which they have been doing to the tune of over $150 billion in the last five years).

These problems could be avoided by increasing the funds available for fusion research. The United States now spends $500 million a year on fusion research. At the same time we spend $4.5 billion a year on the NASA space effort. We should be willing to invest on a comparable level in a program which would result in saving the American economy. Let us increase the funding of our national laboratories, and put an end to the underfinancing of the research departments of our universities and high-technology companies that occurs because of inflation, unfortunate tax policies, and misdirected government allocation of funds. In May 1978, Takeo Fukuda, the then-Prime Minister of Japan, volunteered to contribute $1 billion to the United States fusion effort over the next five years as part of a program to redress the balance of payments, now in Japan's favor. Our government continues to procrastinate. It has been rumored that we would go along with a much smaller effort, partly devoted to coal research—in which the Japanese, who have no coal reserves, are understandably not very interested.

America has been lagging in high technology innovation—a pattern which has become a major concern of the present Administration. A properly funded fusion program could reverse the present downward trend and open a myriad of new innovations, the benefits of which will accrue to all Americans.

The Administration has every right to be concerned with continuing high federal deficits. Certain expenditures, however, can face the most rigid scrutiny. There is no reason why money appropriated for the fusion program could not be capitalized over a twenty- or thirty-year period, exactly as when a corporation builds a new plant. The investment will be returned, in money and quality of life, to our children and children's children a hundred-fold. □

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WM. F. BUCKLEY JR.

The Depths of U.S. Ignorance

On The Right

New York, Jan. 8—Back in 1972 when President Nixon was visiting China and Henry Kissinger was ubiquitous, Art Buchwald wrote a celebrated column the gist of which was that Soviet intelligence had filed a report saying that one member of the President's retinue was a secret official of the United States whose identity and office no one was supposed to know. But, reported Buchwald tongue in cheek, Soviet intelligence had cracked that secret: there is in America something called "the Secretary of State." The incumbent was a man with greyish hair, distinguished features; you could find him in the presidential entourage with the aid of a magnifying glass. He is actually very important . . .

Lev Navrozov, the distinguished Russian expatriate whose heroism and intelligence have made him conspicuous among those few who still care, closes an analysis of the CIA's actions in the Soviet Union during the past few years by saying that serious students of its public performance before congressional committees would be driven to the conclusion that there was a secret CIA out there somewhere: that that is the body that is relaying to us the necessary information about the Soviet Union.

Having done considerable research on the question, from which he distilled his piece "What the CIA Knows about Russia" for *Commentary* (September 1978), he approached a book publisher with his findings. And sure enough, that publisher's response was what one would expect from any American who simply takes it for granted that we *know* . . . somehow . . . from somebody . . . what is going on in the Soviet Union. "I was told," Navrozov relates, "that though my evidence is 'scandalous,' 'public hearings and statements do not necessarily represent the true thoughts of our leaders and congressmen—just as they don't represent those in Russia.'" Navrozov tried to explain that the grave deceptions routinely practiced within the Soviet Union simply cannot be duplicated in the United States. The CIA we all know is the only one there is, and, when its representatives appear before congressional committees, although they might under special circumstances hold back critical data such as a source or two, they would never engage in egregious dissimulations. For instance?

For instance, the published Soviet production of steel is 141 million tons per year. That is 32 million tons more than the U.S. produces. Moreover, the Soviet Union imports steel.

Question: What are the Soviets doing with all that steel? There was much talk, before Senator Proxmire's committee, about the well-known tendency of the Soviet Union to use unnecessary amounts of steel; though when it was pointed out that the newest Soviet tank—more powerful than our newest, and more heavily armed—weighed 17 tons less than ours, there was a nervous silence in the room, it having been pointed out previously that the manufacture of automobiles in Japan (automobiles are the great steel guzzlers) is running at 11 times the per capita rate of automobile production in the Soviet Union.

Apparently we simply do not know what that steel is being used to do. Navrozov scoffs at the assumption that our satellites, simply because they can detect a rabbit running across a Russian steppe, can detect anything of importance. Indeed, it is not plain that the art of concealment may not have outpaced the art of detection. As for the notion that we have contacts on the ground, it turns out that we could not personally confirm or deny whether there had been food riots in Kiev or Rostov three years ago. We know we had a first-class source in Penkovsky, but maladroit arrangements for getting the information from him caused him to be quickly blown, tried, and sentenced to be shot. Our friends in the Kremlin elected, instead of wasting ammunition on Penkovsky, to toss him alive into a crematorium. The CIA's alleged great coup—the publication of Khrushchev's secret speech to the Twentieth Congress—turns out to have been done not only six months after the speech was delivered, but after hundreds of thousands of copies had been read out loud to "half the adult population of Russia."

Meanwhile on our own front, scarcely a season goes by that we do not detect important espionage effected by Soviet agents and their American friends. Our response is symbolized by a recent episode involving the Civil Service Commission. Its chairman, Mr. Alan Campbell, testified before the Senate Subcommittee on Criminal Laws and Procedures concerning the impact that the erosion of law-enforcement intelligence has had on the federal employee security program. Mr. Campbell had, indeed, decided that his files, given the impediments, had become useless, and determined to burn them. In response to a protest from Senators Eastland and Thurmond, he delayed in doing so, but the uselessness of those files, on the basis of which loyalty programs might go forward, remains universally acknowledged.

We are on the eve of a SALT II proposal which is nothing if not dependent on accurate information. As a result of the most recent espionage that has been directed against us (the Kampiles case) we have lost the high-technology edge we had in our verification systems. Meanwhile, on the ground, we have—nothing. The situation is ready for Art Buchwald to write about. □

CAMBODIA IS OVERRUN

New York, Jan. 10—Concerning the galvanic events that have been taking place in Southeast Asia, a few observations:

1. It is an awful symbol of the triumph of Realpolitik that the day should come when men of goodwill must welcome a North Vietnamese invasion of Cambodia. The experience of Cambodia can, with some safety, be written down as the worst experience of any country in the twentieth century, and that includes Armenia, Colombia, Germany, and Russia. The North Vietnamese are a savage race of ideologues whose symbol is the boat people. But at least when they get around to executing recalcitrant Cambodians, they will shoot them rather than bury them alive. The latter was one of the pleasantries of Pol Pot, who, by the estimate of Vietnamese and far more responsible sources, killed sadistically and starved into delirium over one million Cambodians,

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which is to say one-sixth of the population. There being no Jews in Cambodia, one would have to be grateful if it had been invaded by Hitler himself.

2. The howls from the State Department give us the final word on Carter's human rights policy. About a year ago, after the longest silence since the age of Calvin Coolidge, Carter finally got around to denouncing the policies of the Cambodian government as the "worst" affronts on human rights "in the world." Today his representative in the State Department is bemoaning the turn of events. "Our position," said State Department spokesman John Cannon, "has been that Vietnam's intervention in Cambodia is totally unjustified. . . ."

WHY DID he say that? It is obvious that our recent slavishness in dealing with Communist China is seen as requiring that all China's policies become our own. China is struggling with the Soviet Union for influence in Southeast Asia. Accordingly, Cambodia had become the client state of China, which kept the government of Pol Pot freshly supplied with the instruments of torture. Now that the Vietnamese have prevailed, all of Southeast Asia up to the frontiers of Thailand belongs in effect to Vietnam (some Americans, mercifully put out to pasture, used to speak about the domino effect). The fear is that China will thrust south to neutralize Vietnam, which, with the conquest of South Vietnam, Cambodia, and in effect Laos, now governs sixty million people. We are to take it as a threat to China that sixty million wretched Indochinese who hate each other (Laotians hate North Vietnamese, South Vietnamese hate North Vietnamese, Cambodians hate all Vietnamese) will forge a unity that threatens the 900 million Chinese we are taught to be in awe of. China has, in the north, a five-thousand-mile border to defend against the Soviet Union. One would think it unlikely that the Soviet Union would elect to strike out against the government of Peking through Cambodia.

3. Is it Thailand we are worried about? There is certainly every reason to fear the spread of Communist influence in Southeast Asia. But Carter appears to forget that he renounced traditional U.S. claims to intervene in the area, where we fought a bloody and unsuccessful war. The notion that the United States had a right to go to South Vietnam to fight against North Vietnam, but that North Vietnam has no right to fight Cambodians, is at the very least perplexing. But then everything, if viewed through moral prisms, is perplexing. The Chinese are indignant over "imperialism," having a couple of days ago reasserted their ultimate determination to incorporate Taiwan, and having gobbled up Tibet a generation ago. The Soviet Union has reinforced its troops on the Chinese frontier as a show of force to defend the imperialist prerogatives of Vietnam. And the pathetic Sihanouk is flying to the United Nations Security Council, that sanctuary of high international standards, to protest the satellization of Cambodia, via Vietnam, by the Soviet Union—having drunk toasts to the Peking government in the past few years at the rate of approximately one jigger per hundred thousand Cambodians slaughtered by Chinese arms wielded by Chinese clients.

4. I don't quite have the guts to say it myself, so I quote a line from a forthcoming book by Eric Hoffer (*Before the Sabbath*). "The Russians have 900 million Chinese breathing down their necks. We must never try to induce Russia to abandon Communism, and we must do all we can to encourage her to invade China and see to it that she gets bogged down there for good." □

GETTING IT STRAIGHT

New York, Dec. 29—Pride is a cardinal sin, and a regular sinner is the prestige-press. Oh, they will run a correction if they call you Francis Y. Jones and your name is Francis X. Jones, but where interpretation is involved the attitude tends to be regal: "We stand by our story . . ."

Consider the following:

There is a great war raging in Washington. It is between the National Right to Work Legal Defense Foundation and the great monopoly labor unions. The Right to Work Foundation is to the worker what the National Association for the Advancement of Colored People has been for the Negro: a legal lobby that takes up the cause of the individual against The Man—The Man, in the case of the Right to Work people, being any oppressive labor union.

A pitched battle was fought in the courtroom of Judge Charles Richey. The union lawyers demanded to see a list of all the people who had contributed to the Right to Work Foundation (that, incidentally, makes 220,000 people). The Foundation said: No, because you would then be in a position to intimidate such of our donors as you have authority over, e.g., individual workers who contribute or employers who hire them. The union said: We demand the names because only that way can we establish whether the specific officers of a company that hires a worker are in fact financing the worker's case, violating the provision of the Landrum-Griffin Act which bars employers from doing this. The Foundation offered to show the names of the contributors to the judge—but not to the union. The judge ruled that a) the refusal of the Foundation to publish the names is prima facie evidence that the Foundation is in fact guilty as charged (a so-called rule 37 order); but b) the provision of the Landrum-Griffin Act, to the extent it can be relied upon to extort such information, is unconstitutional in that it constricts the right of appeal.

The whole shebang goes to the court of appeals and the three judges there rule unanimously in such a way as to bring joy to the Foundation and consternation to the union lawyers. The court rules that a) the Foundation does not have to give out the names—there are other means by which the union can legitimately seek to discover whether the Landrum-Griffin provision is being violated; b) the Landrum-Griffin provision is therefore not unconstitutional; and c) all that Landrum-Griffin rules out is the *management* of an anti-union case by the company involved, and the union lawyers will have to prove that the Foundation is not independent before they can make a Landrum-Griffin case against it.

Now, that ruling was champagne for the Foundation, and the AFL-CIO press led off its story with a melancholy description of the court's ruling, conceding that the union's case survives now only by its fingernails.

BUT LOOK how the story was handled by the Associated Press. The lead was: "A federal appeals court set aside a lower court ruling that had upheld the right of an anti-union group to finance lawsuits against unions by their members. A three-judge panel here sent the case back to District Court Judge Charles Richey for a decision whether the National Right to Work Legal Defense Foundation is a 'bona fide independent legal aid organization.'" The headline in the *Wall Street Journal* read: "Anti-Union Group/Is Set Back in Ruling/On Financing Suits."

A few more setbacks like that, and the Right to Work Foundation can disband on the grounds that it has nothing left to prove. But although the obvious error in emphasis was pointed out to the *Journal*, and to the AP, they have declined to run corrections. (The *New York Times* has not yet replied.) People who spend as much time as they do talking about the freedom of the press are obliged to admit it when—as occasionally we do—we get something wrong. When there is frank confession of error, one's respect for the press increases, rather than diminishes. □

(Washington Star Syndicate, Inc.)

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Trans-O-Gram

By SVEND PETERSEN

DEFINITIONS

A. A legislative decree of the Roman Catholic Church pertaining to marriages — 62 17 49 182 124 199 167 204

B. A fireproof curtain used in theatres — 202 71 185 104 88 113 170 168

C. What a weary motorist might have under his eyes — 11 54 58 74 91 152 142 67 123 148 / 69 108 131 158

D. A big outgo for most families — 136 83 56 127 162 186 72 191 13

E. A county in Ireland — 155 128 196 163 28 134

F. From the fields there comes the breath of _____ — 19 43 115 120 114 130 144 150 111 176

G. Divine communication of knowledge — 159 146 135 189 194 84 125 31

H. A type of rhetorical understatement — 172 64 57 30 85 140 92

I. Expressed gratitude — 1 33 47 80 25 39 52

J. Wards off — 187 137 66 18 95 105

K. A Greek historian, author of *Anabasis* — 122 143 132 20 46 2 177 174

L. Sly — 139 34 21 101 109

M. Parthenogenesis in which only males are produced — 27 79 100 110 82 94 73 129 147 181 / 16

N. A huge ash tree that binds Earth, Hell, and Heaven together (Norse mythology) — 48 75 9 173 205 200 195 61 35

O. A machine for transporting dirt — 51 15 24 32 38 42 45 77 87 90

P. To color again — 153 3 133 93 160 68

Q. Be sure to include *this when you write* to someone — 26 37 65 78 89 44 99 60 112 117 / 138 164 192

R. . . . I will be free, even to the _____ ——Shrew, IV:3 — 178 188 183 10 156 126 76 203 145

S. Town near Lincoln, England — 107 190 175 149 179 198 50 4 81

T. A Hall at the U. S. Naval Academy is named for this naval engineer — 180 201 86 6 197 22 70 106 63

U. A pipe or passage for conducting smoke or a current of air — 184 36 206 165 12 118 151

V. Put your tobacco in this and smoke it! — 59 119 7 103 96 53 154 166

W. The most westerly of the Aleutians — 102 40 193 171

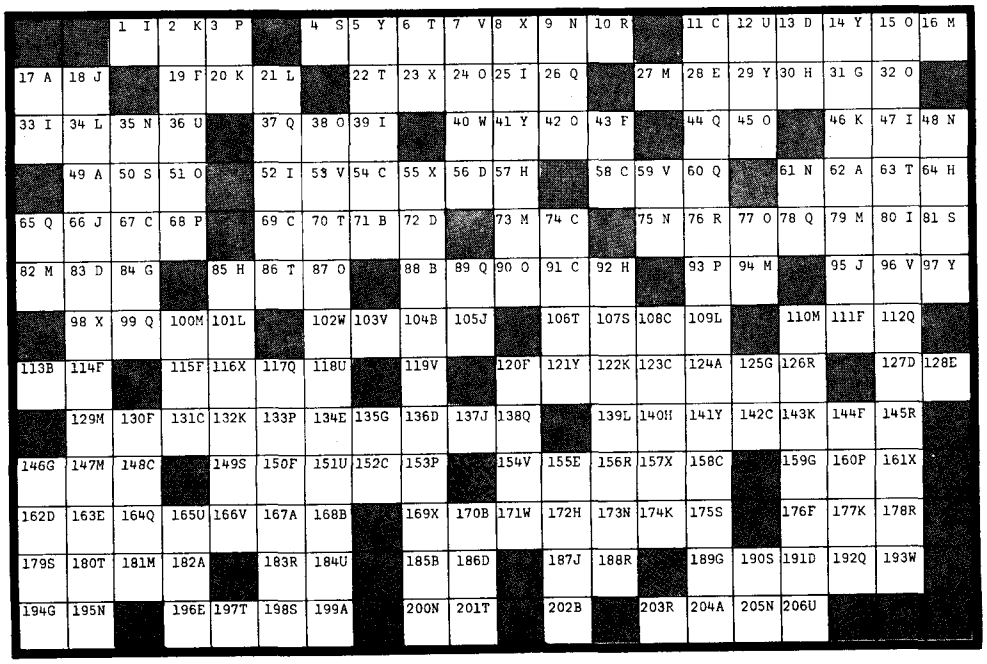
X. City in South Dakota where unneeded employees may be sent to vegetate — 98 55 8 157 169 23 116 161

Y. *The Adventure of the Sussex* _____ (a Sherlock Holmes case) — 5 121 29 14 41 141 97

DIRECTIONS

The object of TRANS-O-GRAM is to fill out the puzzle diagram by guessing the words (above) from their DEFINITIONS, and transferring each letter of the guessed word to the correspondingly numbered square in the diagram. When the diagram is filled out it will spell out a quotation from some published work (reading normally from left to right, black boxes indicating the ends of words); also, when the WORDS have all been filled in above, their initial letters will spell out the author and title of the quoted work. The acrostic feature, and the relative word-lengths in the diagram, will assist in the solution. Spelling and definitions on the authority of *Webster's New International Dictionary*, Second Edition.

See page 188 for Solution to last Trans-O-Gram.



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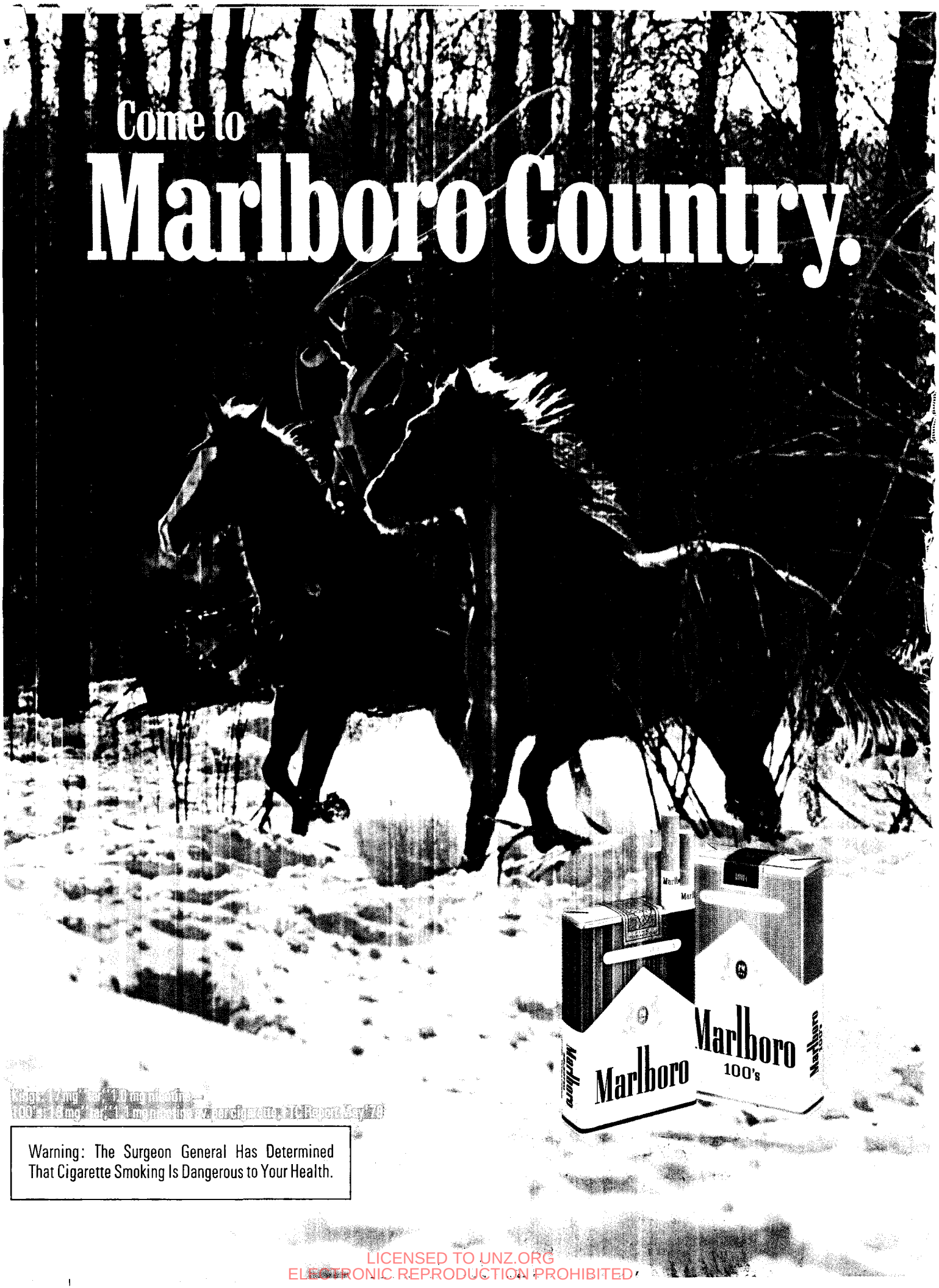

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